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ELECTRICAL WORLD

MAY 23, 1931
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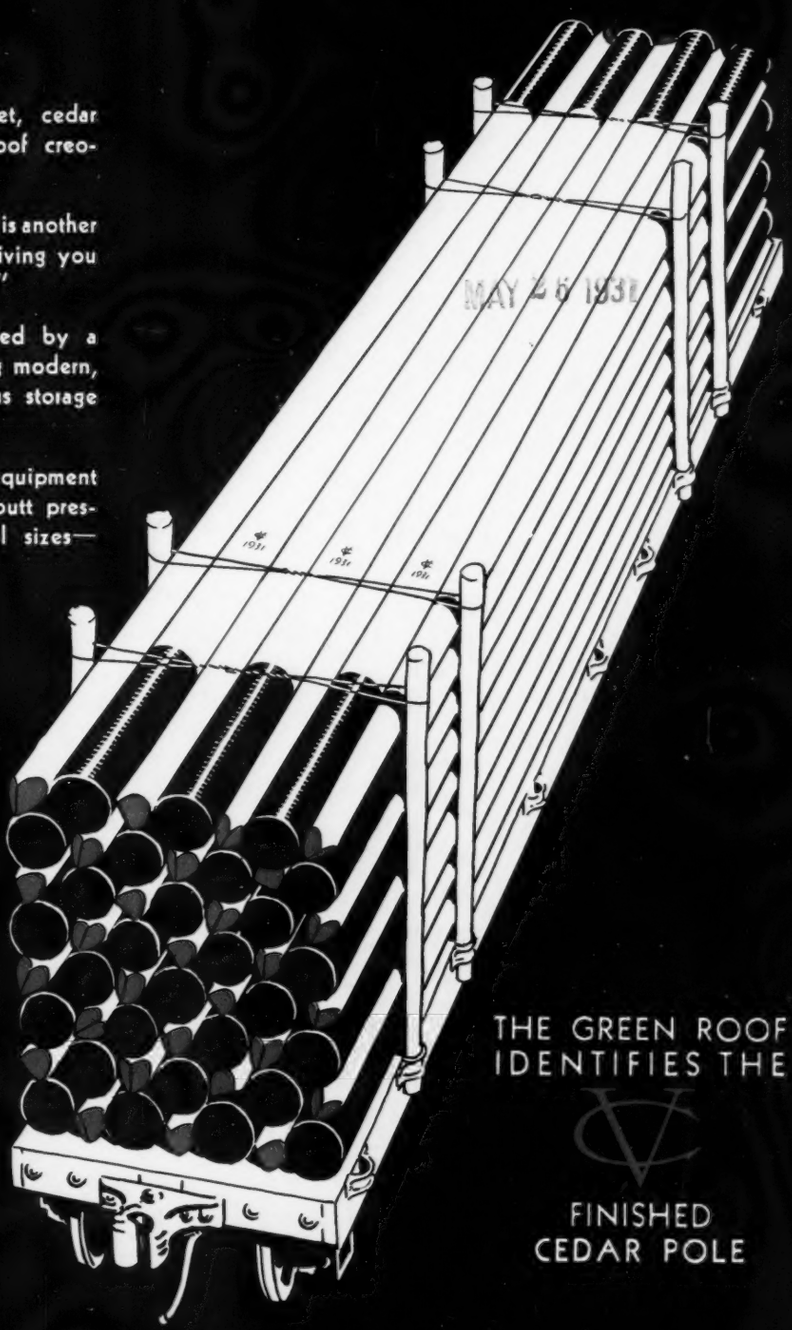

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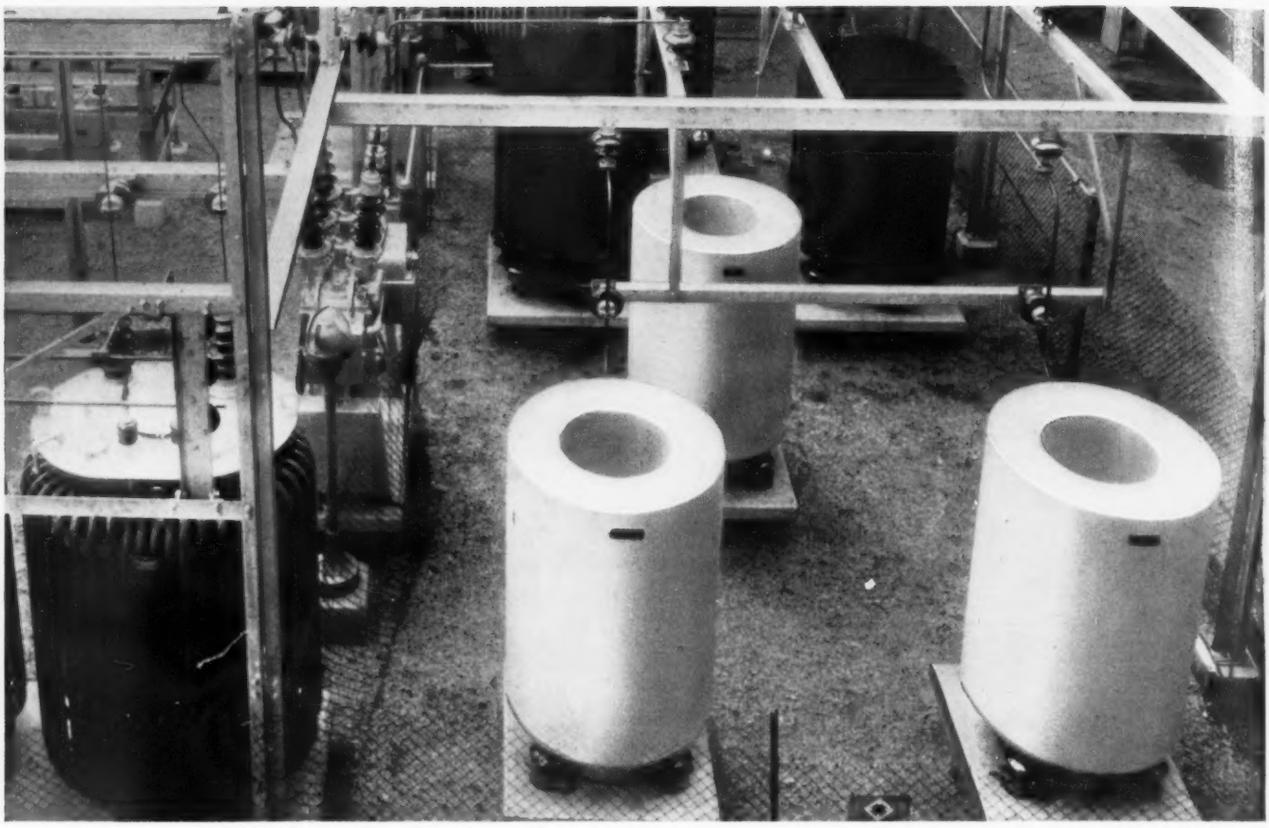

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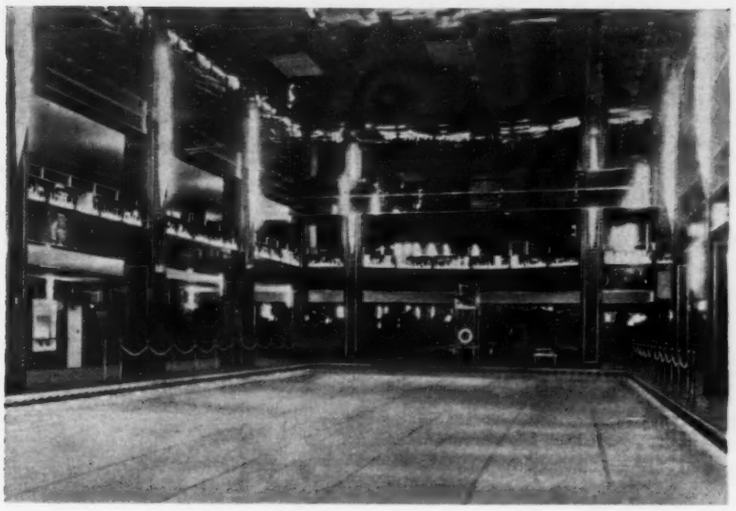

Swimming pool illumination Hotel St. George, Brooklyn, N. Y.

MAY 23, 1931

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As Simple as a Pencil

ELECTRICAL WORLD

for the Week Ending

May 23, 1931

Stock market scrapes bottom again

—**Security prices flounder low** as averages drop to levels of 1927. Utility issues show comparatively good resistance, though Steel, Can and A. T. & T. fall in wave of professional pessimism—*p. 969.*

—**Material handling costs cut** by efficient use of industrial electric trucks. Balance sheet proves value of flexible, convenient and always-available storage battery units—*p. 950.*

What the world is going to do about Russia is the most important unsolved problem in the world today. My own belief is that communism cannot eventually succeed because it so totally ignores human nature.

HUGH L. COOPER,
American hydro-electric engineer, builder of Dnieperstroy, Keokuk, Muscle Shoals.

Federal utility hearings resumed

—**North American Company up** in public utility investigation. Operating property in Cleveland praised by federal accountants as officers of holding company appear on the witness stand—*p. 935.*

—**Farm experiment successful.** Red Wing project of Minnesota Committee on Relation of Electricity to Agriculture demonstrates value of electric service in reducing farm costs—*p. 937.*

—**Welded boiler acceptability** gaged by queries to utility executives and engineeering or operating department heads. Open-mindedness and willingness to accept evidence of reliability indicated in replies—*p. 955.*

Economies justify system planning

—**System planning in California** improved quality of service and reduced cost to the consumer as well. Also rendered the operating man's life somewhat easier. Needs of rapidly growing territory influenced action—*p. 944.*

—**220-volt motors on 208 volts** show but eleven per cent loss in torque and one per cent drop in efficiency without unsafe temperature rise. Few unfavorable effects seen on motor installations in network changeovers—*p. 958.*

—**Commercial baking-cooking** adds 32,000,000 kw.-hr. and $700,000 to revenue of 24 utilities in 1930. Average of $42 per kw. per year indicates value of this electric heat load. Development needed—*p. 963.*

Arizona loses its Hoover Dam suit

Arizona Loses Its Last-Ditch Fight to Stop Construction of Hoover Dam

NO OBSTACLE to the construction of Hoover Dam across Boulder Canyon in the Colorado River on the Nevada-Arizona boundary is imposed by the decision of the United States Supreme Court, made public on May 18, in the suit of Arizona to prevent this hundred-and-sixty-five-million-dollar undertaking of the federal government. The court upheld the constitutionality of the Swing-Johnson act, which Arizona's representatives had consistently fought, and declared, through Justice Brandeis, that Arizona's claim of injury "cannot prevail, because it is based not on any actual or threatened impairment of Arizona's rights but upon assumed potential invasions." A ray of hope is left to the hard-fighting state, which on this matter so determinedly separated itself from the other six commonwealths of the Colorado River Basin, for the decision says:

> There is no occasion for determining now Arizona's rights to interstate or local waters which have not yet been, and which may never be, appropriated. The bill is dismissed without prejudice to an application for relief in case the stored water is used in such a way as to interfere with the enjoyment by Arizona, or those claiming under it, of any rights already perfected or with the right of Arizona to make additional legal appropriations and to enjoy the same.

In preceding paragraphs of its finding the court declares:

> Into the motives which induced members of Congress to enact the Boulder Canyon project act this court may not inquire. The act declares that the authority to construct the dam and reservoir is conferred, among other things, for the purpose of "improving navigation and regulating the flow of the river." As the river is navigable and the means which the act provides are not unrelated to the control of navigation, the erection and maintenance of such dam and reservoir are clearly within the powers conferred upon Congress.
>
> Whether the particular structures proposed are reasonably necessary is not for this court to determine. And the fact that purposes other than navigation will also be served could not invalidate the exercise of the authority conferred, even if those other purposes would not alone have justified an exercise of congressional power.

▼

N.E.M.A. to Study Marketing and Distribution

STABILIZATION AND CO-OPERATION were stressed as business necessities at the meeting of the National Electrical Manufacturers' Association at Hot Springs, Va., May 17 to 21. Individual reports of poor business could not dim firm faith in the future on the part of the 400 manufacturers' representatives, who at once began to plan association studies of marketing and distribution—a course urged upon them in the addresses of industry leaders.

President C. L. Collens in his opening speech said that only a minor degree of business demoralization had manifested itself in the electrical industry. Despite the depression he hoped that sane and intelligent competition would continue, and he declared that this was an especially good time to study marketing and distribution problems. Some branches may face decreased markets in future years, Mr. Collens said, and each manufacturer should supplement his individual efforts by co-operation in any constructive program sponsored by business groups. He pointed out that many problems could be solved more economically and readily by N.E.M.A. co-operative effort than by manufacturers working alone.

Malcolm Muir, president McGraw-Hill Publishing Company, expressing his faith in business leadership, made similar suggestions. He asserted that American industry had given a very favorable reception to the "Platform for American Business" recently announced by McGraw-Hill. Mr. Muir cited banker and industrial comment supporting the principles of the platform and said that the trade association was a logical and necessary agency for carrying out many business controls and principles. He urged that business as individual organizations and as groups introduce facts, studies and controls that will enable industry to deal intelligently with social and economic forces.

C. H. Hatch also urged the necessity for business groups to study marketing and pointed out the need for facts. He cited the wiring group of manufacturers and the home market as a case in point and suggested a definite program of fact finding and sales promotion that might be sponsored by the N.E.M.A. for this group.

The section and group meeting of the association were given over to constructive work for better and more stable business.

▼

Edward D. Adams Dies in Eighty-sixth Year

EDWARD DEAN ADAMS, inseparably connected in electrical history with the generation of water power from Niagara Falls and the introduction of alternating current, died at his home in New York City on Wednesday morning of this week after he had been thought to be on the way to recuperation from painful injuries and shock received in an automobile accident near Aiken, S. C., on March 29. Mr. Adams was 85 years of age and had planned before the accident occurred to go from Aiken to

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LATEST ELECTRICAL SAFETY DEVICE AT SEA

—Canadian Pacific News

Floodlighted funnels, soaring 128 ft. above the water line, will be visible at sea 30 miles away, or an hour before the Canadian Pacific liner Empress of Britain, *which carries them, will come into view. This 42,500-ton steamer will sail from Southampton May 27 on her maiden voyage to Quebec.*

Fort Myers, Fla., to visit Thomas A. Edison, his junior by a year.

Born in Boston and receiving a year's technical training at the Massachusetts Institute of Technology after graduation from Norwich University in Vermont, the first part of Mr. Adams' long business career was spent with Boston banking houses and in the direction of railroad and other large enterprises. Among numerous directorships held by him was one on the board of the Edison Electric Illuminating Company of Boston, but it was not until about 1892 that his real service to electricity began. In that year he became president of the Niagara Development Company, formed to promote the hydro-electric plant at the Falls which was completed in 1895 by the Cataract Construction Company, also under his presidency.

Mr. Adams organized a group of scientists known as the International Niagara Commission, headed by Lord Kelvin, which indorsed his idea except in the proposal to use alternating current. How with the aid of George Westinghouse this plan, then considered revolutionary, was made a reality is part of the packed drama of electrical development.

Mr. Adams' affiliations with finance, industry, engineering, art and education were very wide, and honors were showered upon him at home and abroad A fuller sketch of his career will be printed next week.

▼

North American Unit in Cleveland Is Praised

INQUIRY BY THE Federal Trade Commission into the North American Company, which controls the principal light and power operating companies in Cleveland, St. Louis and Milwaukee and has extensive interests elsewhere, was begun in Washington on May 13.

W. B. Horne, a commission accountant, told in detail of the connection of officers and directors of the North American Company with subsidiaries. He said that 68 officers were connected with two or more companies and seven with 20 or more in the group. Save for the 27.8 per cent held by Harrison Williams, ownership of the common stock was widely scattered. Other commission men testified along similar lines.

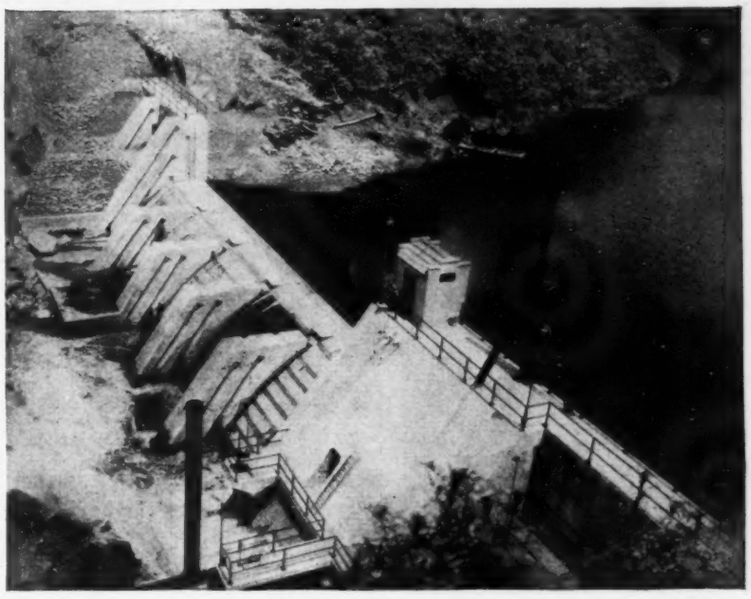
The second day's hearing was notable because of an encomium pronounced upon the Cleveland Electric Illuminating Company by Judson C. Dickerman, the commission's expert examiner. Although the Cleveland company's operations are all intrastate, Mr. Dickerman said that it "has been found to have some operating practices and results which may be valuable in the final analyses of the results of this investigation." He asserted that inasmuch as it has not been subject to mergers and reorganizations, "with the consequent distortion of records and accounts," it "furnishes one of the clearest and longest electric utility histories likely to be encountered in this investigation." It has, moreover, "one of the simplest, plainest, least-limited set of rate schedules" he had seen.

Cleveland's municipal plant, Mr. Dickerman said, serves certain districts only and has a business only 10 or 15 per cent of the company's. The company does not actively compete in the districts served by the city plant, though there is some duplication in the border territory between the two systems. The examiner stated that the rates of the two systems apparently have been mutually reactive. The private company has not attempted voluntarily to meet the city rate on small-consumer business, which is 3 cents a kilowatt-hour plus a service charge of 30 cents, while the city evidently "has watched the wholesale rates of the private company with the intention of undercutting them as little as possible."

Commendation was epitomized in the declaration that the management of the Cleveland Electric closely approaches "that which may be expected of a public utility under good conservative management which conforms to the best ideals of public regulation."

History of organization, distribution of stock holdings and acquisition of properties by the North American Company were disclosed when hearings were resumed on Tuesday of this week. A. E. Lundvall, a commission examiner, was the only witness. On Wednesday similar testimony was adduced concerning the West Kentucky Coal Company and Washington Railway & Electric Company.

BRAZIL DEVELOPS ITS HYDRO-ELECTRIC POWER



Thirty-five miles from Curityba, the capital of the State of Parana, Brazil, the Chamine hydro plant, with an initial installation of 8,000 kw., has just been built on the Rio Sao Joao in a mountain region heretofore almost inaccessible. It transmits power at 66,000 volts over a steel-tower line throughout the Curityba district. The plant is controlled by the American & Foreign Power Company of New York.

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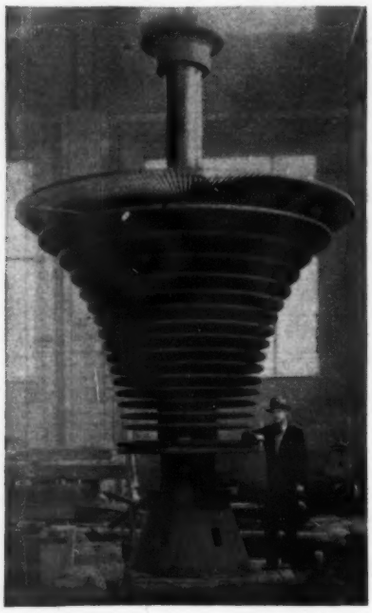
Supreme Court Upholds Indiana Chain Store Tax

A RECENT DECISION of the United States Supreme Court upholding Indiana legislation imposing a special tax on chain stores has interested utility companies that maintain such stores for the sale of appliances, since similar laws are likely to be adopted by other states now that their constitutionality has been vindicated. North Carolina and Mississippi have already such laws. Their statutes also now await adjudication in the United States Supreme Court.

A district court in Indiana enjoined the collection of the tax in that state as discriminatory, since it imposes an annual fee of $3 for one store, $10 each for the second to the fifth and so on in an ascending scale. The statute had a narrow escape from being upset, the court of final appeal dividing five to four in sustaining it.

NEW ROTOR FOR HUNTLEY



This seventeen-stage horizontal-shaft rotor has recently been installed at the Buffalo General Electric Company's steam station as part of the 80,000-kw. generating unit under installation there.

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Power and Regulation in State Legislatures

ARIZONA.—A bill establishing a state board to make a survey of conditions relating to public utilities and their service and to provide for a physical valuation of the properties of corporations and individuals engaged in public utility service has been defeated in the House.

ILLINOIS.—Only one public utility bill now appears on the calendar of each branch of the General Assembly. The House bill providing that city councils may place money derived from municipally owned public utilities in a special fund for their operation is on third reading. A Senate bill provides that complaints for recovery of damages be filed with the commission within two instead of three years after the occasion. Another Senate bill, not on the calendar, would authorize the resale of service by municipal utilities and would require public utilities to sell service to municipal corporations, upon request, without discrimination. A House bill provides that no order giving eminent-domain authority to a public utility shall be entered by the Illinois Commerce Commission until every person having an interest has been notified. Another House bill creates a commission of five members from both legislative branches to investigate rates. All high-tension lines would have to be laid in conduits under public highways or privately owned land by the terms of a third House bill. Of three other bills introduced in the House by Representative O'Keefe, one would withdraw from the Commerce Commission all jurisdiction over the operation of public utilities within the corporate limits of cities and vest it in the city authorities; another provides that decisions of a city may be appealed from in the same manner as in cases under the Commerce Commission, and the third permits municipalities to pay for purchase, extension or improvement of utility plants from the net earnings.

KENTUCKY. — The Democratic party of the state has declared in favor of regulation of all public service corporations, for the conservation of water-power sites and other natural resources and for laws to develop and control power sites and establish just rates for electrical energy.

PENNSYLVANIA.—With the Governor's Fair Rate Board bill defeated in the Senate, as reported last week, efforts to pass in the House the Howell bill—adopted by the Senate early in the session—after five amendments had been made to it in line with Mr. Pinchot's ideas resulted on Wednesday in its passing second reading, attempts to defeat the amendments being lost by majorities approximating two-thirds. Final passage by the House on Monday is expected. The chief amendments give the Governor power of removal over the commissioners and give the commission control over the issue of securities and over mergers. This measure as amended is expected to have rough sledding in the Senate. In the meanwhile the tongue-lashing contest between the Governor and his supporters on the one side and the other Republican faction on the other goes on as noisily as ever.

TEXAS.—A provision of the "bond and warrant" bill passed finally by the Senate with numerous amendments that will necessitate its reference to a conference committee relates to the issuance by cities of evidences of indebtedness either to buy an existing public utility privately owned or to set one up to compete with it. In the first case whether the utility shall be purchased and the price proposed shall be submitted to the voters. In the second case the bill affirms the authority of municipalities to mortgage a utility and its income as a means of acquiring it.

WISCONSIN.—The Loomis state utility corporation bill (ELECTRICAL WORLD, April 11, page 665) has been favorably reported by the Senate corporations and taxation committee, with amendments, following an attack upon it by utility representatives, who called the bill in its original form a legislative usurpation of the people's rights. As amended, the bill, Senator Loomis said, has four functions: (1) Unifying of all power facilities, private and public, with the development directed toward providing electric power and other utility service at a low cost; (2) providing expert and advisory service to publicly owned utilities, of which there are nearly 90 now in Wisconsin; (3) permitting ten-year contracts by the state utility corporation with private utilities to stabilize rate bases for purposes of regulation and to establish purchase prices; (4) setting up an organization that can function after the constitution is amended to permit the entry of the state into the utility field. The Senate committee also recommended for passage the Duncan bill (ELECTRICAL WORLD, May 9, page 838), which revises the statutes governing regulation of utilities. The Assembly has engrossed the Groves regional utility tax bill providing for taxation of public utilities at the average rate of districts in which they operate instead of at the rates now set by the state. A proposed substitute for the Carow corrupt practices bill (referred to on May 9, page 839) was submitted to the Senate judiciary committee last week. The new bill makes nine important changes, removing newspapers from the classification of corporations prohibited from taking part in state campaigns, but still not exempting utilities.

▼

Special Contracts to End; Delinquent Tax Defended

HEARING LAST WEEK by the New York Public Service Commission on the legality of special contracts for electric service brought a promise from representatives of eleven light and power companies in the metropolitan district that such contracts would be eliminated in future and that standard rates would be adhered to. Only sixteen such contracts were found in existence in the down-state territory, and for these reasons the companies thought adequate were given. They will be filed for the commission's approval and changed if necessary. A hearing will also be held upstate.

At another hearing the practice of the Buffalo and other subsidiaries of the Niagara Hudson Power Corporation in charging delinquent consumers an extra 10 per cent on their monthly bills was defended by William Kelly, vice-president, on the ground that it places the cost of collecting delinquent bills where it properly belongs. Previous to the first of this year the Buffalo company had been giving its customers a discount of 10 per cent for prompt payment. This, according to Colonel Kelly, was not satisfactory in

reducing the number of delinquent bills, which amounted to 30 per cent of all bills submitted during 1930.

The commission will make a decision in this case which will apply to all power companies in its jurisdiction.

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A. C. Network in Chicago Will Supplement D. C.

To care for the growth of electrical load in downtown Chicago the Commonwealth Edison Company will, according to a plan recently made public by R. F. Schuchardt, the company's chief electrical engineer, install an alternating-current network to supplement the present direct-current distribution in that part of the city. Economy in first cost and operation is the main reason for the change. Besides that, and more immediately compelling, is the necessity of relieving congestion in numerous streets and alleys where new loads contracted for or in prospect would add to it were direct current supplied.

It is the intention of the company, Mr. Schuchardt says, to supply alternating current in what is now the direct-current area, to be known hereafter as the inner zone. The present direct-current system, however, will not be supplanted. The outer zone, which includes all the rest of the city, already uses alternating current. The first new installation will be for the large tower office building erection of which by the Marshall Field estate will be started this summer in the block just west of the Edison Building. Another beginning point will probably be the new post office just west of the Chicago River, which is to be built over the tracks entering the Union Station from the south.

▼

Camp Co-operation XI to Meet Last Week in July

Completing the first decade of the Electrical League movement, Camp Co-operation XI, the tenth annual summer conference of leagues, will be held at Association Island, Henderson Harbor, N. Y., July 27 to 31, inclusive. These meetings, sponsored by the Society for Electrical Development and held under the auspices of the League Council, have grown to be veritable conventions attended by leading figures from all branches of the industry.

G. W. Weston, secretary-manager of the Electric and Radio Association of Kansas City and chairman of the League Council, will be general chairman of the meeting. J. E. North, president of the Electrical League of Cleveland, is chairman of the business program committee.

Red Wing Experiment Entirely Successful

Striking success is reported by the Minnesota Committee on the Relation of Electricity to Agriculture regarding its experimental work on five farms in a report just issued covering progress in the seven years since the experiment was launched. The report, made public by the College of Agriculture of the University of Minnesota, brings out the fact that the experiment was a prime factor in the extension of electric service from central power plants to 10,000 Minnesota farms. In 1923 only 3,000 farms of the state were served by power companies. Today there are 13,000 such farms.

Much of the needed equipment was loaned to the owners of the five farms, which are near Red Wing, but some of it was purchased by them. In all, $16,667 worth of machinery has been used. "The fact that these farmers have paid heavy electrical bills and yet have decreased operating expenses indicates that electrical service may decrease other expenses by more than its own cost," says the committee's report. "The five farmers paid electric bills amounting to $842, or $14.04 per farm per month in 1926, and $886, or $14.77 per farm per month, in 1927, while in 1924 the total electric bill was $501, or an average of $8.35 per month. Yet operating expenses for all five farms in 1926 were $907 less than in 1924 and in 1927 were only $101 more than in 1924. In fact, if taxes on these farms had not increased appreciably during the four years, the expenses for each of the last three would have been considerably below those for 1924."

▼

California Commission Makes Report on Drought

A report on water supply has been compiled by Major M. R. MacKall, hydraulic engineer of the California Railroad Commission, and P. E. Harroun, assistant hydraulic engineer. It indicates that the present and prospective conditions for this season closely approximate, or are possibly slightly better than, conditions in 1924, which followed the most serious drought in the last half century or more.

The report, which agrees with the summary of the situation printed in the Electrical World for April 25 (page 750), shows that in that section of the state approximately north of the Tehachapi the rainfall has been much below normal, ranging from about 40 to 60 per cent in general, with some areas showing as low as about 35 per cent and others as high as about 65 per cent. The consequent stream flow has been in general in volumes and ratios below

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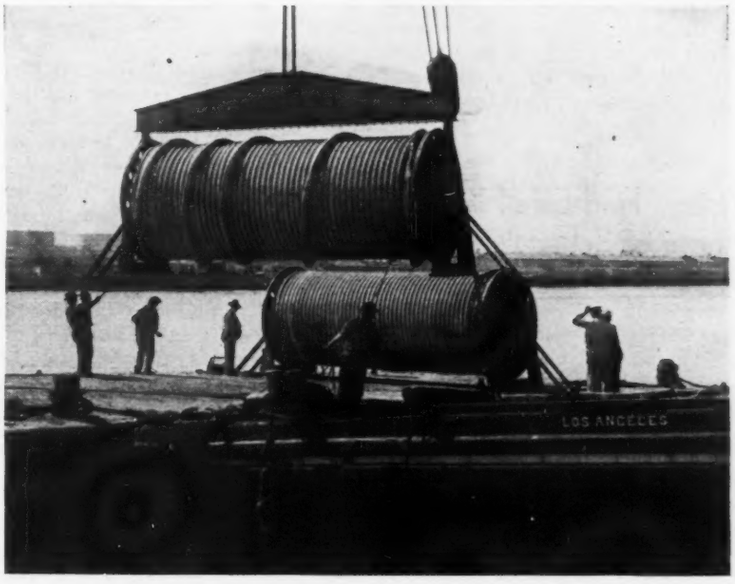
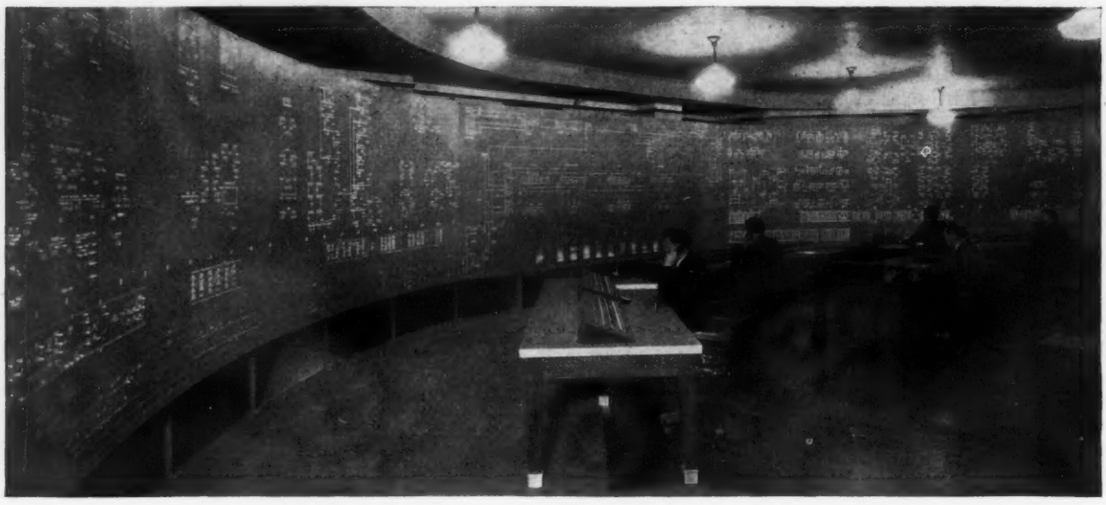
LOADING 28-TON REELS OF CABLE ON BARGE FOR LAYING



The Southern California Edison Company lately received from the Okonite Company, Passaic, N. J., four reels of three-conductor steel-armored submarine cable to be laid in Cerritos Channel from the Long Beach steam station on Terminal Island to the Proctor & Gamble soap plant on the mainland, whose initial demand will be 5,000 hp., delivered at three substations. There is 2,700 ft. of cable in each reel. The cables were to be laid simultaneously 10 ft. below the channel bottom.

COMMONWEALTH EDISON COMPANY HAS NEW SYSTEM CONTROL BOARD



Division into three independent sections, two devoted to switching operations and the third entirely concerned with load control, is the conspicuous feature of the new semi-circular system-operating board, 68 ft. long, of the Commonwealth Edison Company. Load control is very important because much energy for Chicago is purchased from outlying stations—State Line, Powerton and Waukegan—not operated by the Commonwealth Edison.

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those representing rainfall. For instance, the run-off of the Sacramento River at Red Bluff and of the San Joaquin at Friant represent 20 per cent and 10 per cent respectively of the normal seasonal flow. Conditions in the Owens Valley, Los Angeles, San Gabriel and Santa Ana drainage areas and the Santa Clara Valley are of the same general character as over the rest of the state, but reports indicate that while stream flow will be low the demand will be met by supplemental pumping from underground basins.

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Visitors Find Safe Harbor Ahead of Schedule Time

CONSTRUCTION OF THE hydro-electric generating plant and mile-long dam on the Susquehanna River at Safe Harbor, Pa., was found well ahead of schedule by a party of eminent executives and engineers from Montreal, Boston, New York, Philadelphia and Baltimore who visited that undertaking on May 15 as guests of the directors of the Safe Harbor Water Power Corporation, the Pennsylvania Water & Power Company and the Consolidated Gas, Electric Light & Power Company of Baltimore, the three organizations controlled by the J. E. Aldred interests which are responsible for the development. It is expected that power from the new plant, which will have an initial rating of 255,000 hp. and an eventual rating of 500,000 hp., will be delivered early next winter. The 220-kv. transmission line to Baltimore is under way, with its completion also scheduled for this year. The Arundel Corporation of Baltimore is building the dam.

Safe Harbor will be interconnected with the hydro-electric and steam plants of the Pennsylvania Water & Power Company at Holtwood, and the combined developments will constitute one of the largest sources of hydro-electric power on this continent. The entire initial output at the new plant will be purchased by the Pennsylvania Water & Power Company and the Consolidated Gas, Electric Light & Power Company of Baltimore, which together formed the Safe Harbor Water Power Corporation to carry through the plan.

The party which visited the site last week included J. E. Aldred, chairman of the board of each of the companies; Herbert A. Wagner, president, and Charles M. Cohn, vice-president of the Consolidated Gas, Electric Light & Power Company; Charles E. F. Clarke, president, and John A. Walls, vice-president and chief engineer of the Pennsylvania Water & Power Company and the Safe Harbor Water Power Corporation; John R. Freeman, Providence, R. I.; S. Z. Mitchell, chairman of the board Electric Bond & Share Company; Thomas N. McCarter, president Public Service Corporation of New Jersey, and Lucius S. Storrs, president United Railways & Electric Company of Baltimore.

When the Safe Harbor plant begins its delivery of power to Baltimore at the end of this year the Consolidated Gas, Electric Light & Power Company will, Vice-President Cohn announces, change the frequency of 62½ cycles to which the company has clung to the 60 cycles standard almost everywhere, thus facilitating interchange of energy with other companies.

Another 220-kv. line will be built from Safe Harbor to Baltimore in 1933, approaching the city from the east by way of Riverside. The one now being built goes round by Westport.

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Los Angeles Power Bonds Not to Be Voted on Now

THE LOS ANGELES CITY COUNCIL on May 12 voted unanimously to deny the request of the Water and Power Commission to submit a power-bond issue for $15,300,000 to the voters at a city election called for June 2. The request was refused on the ground that with only three weeks in which to conduct a campaign the issue would be defeated.

The Water and Power Commission had adopted resolutions asking the Council to put on the ballot proposals in the amounts of $7,000,000 for construction of a steam-electric generating plant, $2,000,000 for the acquisition of a right-of-way for the proposed transmission line to bring power to the city from Hoover Dam and $6,300,000 for the betterment and extension of the present municipal power system.

Los Angeles voters last fall defeated a proposed power-bond issue of $13,300,000, which included the transmission line and general improvement items but not funds for the proposed steam plant.

Scattered Happenings in the Electrical Sphere

UNITED STATES

Wisconsin Commission Kept Busy

Thirty-three petitions are pending before the Wisconsin Railroad Commission for changes in rate schedules or in service rules of public utilities, and applications have been received from 54 other municipalities for blanks upon which to file petitions for lower rates.

Moultrie, Ga., Buys Company Plant

The Moultrie (Ga.) City Council has purchased for $40,000 the Diesel-engine power plant of the Georgia Power Company and called off a special election to vote on a measure to construct one. The city will sell to the power company the complete output of both the Diesel-engine plant and the city's steam plant.

Contract for Eagle Pass Plant Let

Contract for construction of a 12,000-hp. hydro-electric plant near Eagle Pass., Tex., has been awarded by the Central Power & Light Company of San Antonio, an Insull subsidiary, for approximately $1,000,000. The water will be taken from the main canal of the large irrigation system which is now being constructed at a cost of $6,000,000, with an intake on the Rio Grande.

General Electric Entertains Engineers

As guests of the General Electric Company more than 450 members and friends of the New York Electrical Society and the New York Section of the Illuminating Engineering Society journeyed to Schenectady on June 15 on two special trains to visit the research laboratories of the company, popularly known as the "House of Magic," where the latest developments of electric science were demonstrated to them.

Madison Lobbying Charges Dismissed

Circuit Judge A. G. Zimmerman of Wisconsin, after dismissing lobbying charges against Paul Raihle and Ethan B. Minier, also dismissed without prejudice the charge against William J. Hagenah, general counsel for the Byllesby Engineering & Management Corporation, on motion of the Attorney-General, for lack of evidence. (See ELECTRICAL WORLD for Apriy 11, page 665.)

Indianapolis' New Generating Station

Announcement is made that the new 70,000-kw. Harding Street generating plant of the Indianapolis Power & Light Company will be opened for public inspection in August or September and go into operation about the first of next year.

No Rehearing on California Rates

Application of the San Joaquin Light & Power Company and the Midland Counties Public Service Company for a rehearing of the California Railroad Commission's recent decision, reducing rates of the companies tentatively by $600,000, has been denied pending final settlement of the controversy involving numerous localities and the major power and light companies in central California.

Plans for Oak Grove Plant

Complete development of the Oak Grove (Ore.) project as originally planned took another step forward recently when the Pacific Northwest Public Service Company let a contract for 3,500 ft. of tunnel between the main fork of the Clackamas River and the Oak Grove Creek. The tunnel, which is to be 10 ft. in diameter, will ultimately be 3.7 miles long and will deliver water from the main fork of the river to the present intake of the Oak Grove plant. It is planned to take three years to complete the tunnel, which at first will be an open conduit. When the main fork of the Clackamas River is dammed to supply storage, the tunnel will be lined and operate as a pressure conduit.

Sixty-Cycle Energy for Syracuse District

Rebuilding of much of the important Solvay (N. Y.) switching and transformer station and further linking of Syracuse with the upstate power network through a new switching station at Gere's Lock is announced by the Syracuse Lighting and the Niagara, Lockport & Ontario units of the Niagara-Hudson system. The object is to make 60-cycle energy available through all this territory. A 110-kv. double-circuit line from Gere's Lock to Long Branch will connect with the Mortimer-Solvay and the northern and eastern trunk lines.

South Texas Has New Line

Completion last week of a 70-mile transmission line between Falfurrias and Edinburg in south Texas by the Central & South West Utilities Company marks the close of a five-year program during which 1,000 miles of line a year have been built.

McKenzie River Potentialities

Total potential water power of the McKenzie River Basin in Oregon, without storage, is 290,000 hp. for 90 per cent of the time and 444,000 hp. for 50 per cent of the time, according to recent Geological Survey investigators. With storage at four proposed reservoir sites potential power for 90 per cent of the time would be increased to 325,000 hp., but for 50 per cent of the time it would remain unchanged.

CANADA

Service Spreads in New Brunswick

For the 65-mile Grand Lake-Moncton transmission line which the New Brunswick Electric Power Commission is building across the center of that province from its new 5,000-kw. pit-mouth generating station in the Minto coal area 360 steel towers have been ordered. A line in the opposite direction has been completed from the generating station at Newcastle Creek to Moncton. Rural service is expected to follow rapidly.

Beauharnois to Build 220-Kv. Lines

In preparation for delivery of 250,000 hp. to the Hydro-Electric Power Commission of Ontario under the contract already in force, the Beauharnois Light, Heat & Power Company plans two 220-kv. transmission lines. Application to the Quebec Public Service Commission sets forth that the lines, built on towers 1,056 ft. apart, will cross the Ontario border in the Rivière à Beaudet district. Power is to be transmitted from the Beauharnois plant, near Melocheville, Quebec, via a 23-mile line to the border and thence to a substation outside Toronto.

ABROAD

Bond & Share Buys Bucharest Plants

The American & Foreign Power Company, through the Electric Bond & Share Company, has acquired, subject to the approval of the Roumanian Parliament and other public authorities, the electric and gas properties owned and operated by the city of Bucharest. Arrangements have also been effected for the purchase from French-Belgian interests of hydro-electric properties outside Bucharest whose output is now sold for distribution by the municipal system. The investment approximates $12,000,000.

Coming Meetings

National Electrical Wholesalers' Association—Hot Springs, Va., May 27-30. E. Donald Tolles, 165 Broadway, New York.

Wisconsin Utilities Association — Accounting Section, Racine, May 28-29. J. N. Cadby, 135 W. Wells St., Milwaukee.

Association of Electrical Maintenance Engineers—Mayflower Hotel, Akron, Ohio, June 4 and 5. S. C. Hansen, 640 N. Main St., Akron.

National Electric Light Association—Atlantic City, June 8-12. A. J. Marshall, 420 Lexington Ave., New York.

Public Utilities Advertising Association—New York, June 14-16. Room 1748, 4 Irving Place, New York.

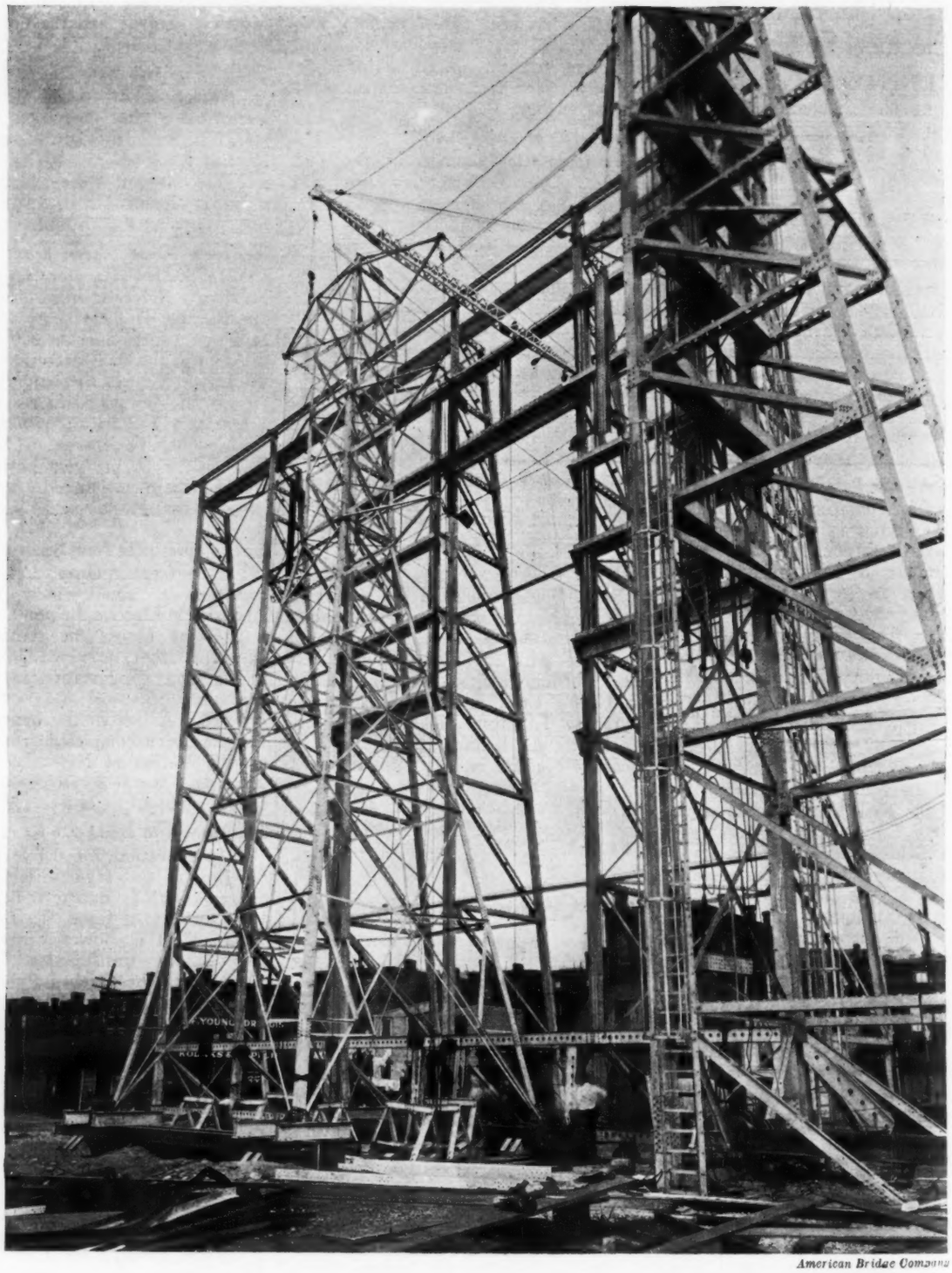
Association of Iron and Steel Electrical Engineers — Cleveland, June 15-19, J. F. Kelly, Empire Bldg., Pittsburgh.

Canadian Electrical Association—Banff Springs Hotel, Banff, Alberta, June 16-18. H. M. Lyster, 407 Power Bldg., Montreal.

American Institute of Electrical Engineers — Summer convention, Asheville, N. C., June 22-26; Pacific Coast Division, Lake Tahoe, Calif., Aug. 25-28. F. L. Hutchinson, 33 W. 39th St., New York.

Pacific Coast Section, N.E.L.A.—Del Monte, Calif., June 24-27. K. I. Dazey, 447 Sutter St., San Francisco.

Camp Co-operation XI — Association Island, Henderson Harbor, N. Y. July 27-31. Society for Electrical Development, 420 Lexington Avenue, New York.



American Bridge Company

Tower tests simulate and exceed usual service conditions

Full-size tests of transmission towers are relatively easy and highly accurate procedures when such test frames as this are available. Designed to fine limits to be as economical of time, labor and material as possible, towers must have service characteristics of a definitely predictable nature. In this instance complete analysis of footings and towers may be made. A concentrated pull of 110,600 lb. 85 ft. above grade has been applied.

EDITORIALS

L.W.W.MORROW
Editor

Highways to success

ELECTRICAL men believe that private initiative and enterprise can continue to improve electric service and reduce its cost. They believe in the integrity of their industry and in the principle of state regulation. They know that electrical markets are only half supplied and that engineering and inventive genius will continue to improve service facilities and introduce new and better products. They know that the industry has proved its merit and stability in the business depression. Thus they will meet at Atlantic City next month with the usual enthusiasm, courage and confidence.

But it is apparent at this time that the future of the industry must be gaged very largely by influences outside its internal technical, management and business activities. The utilities face, as all large business faces, the problem of integrating themselves with the social, political and economic environment in which they operate. They must do their part in calming national disturbances such as those caused by overproduction, unemployment, government in business and socialization of industry. In addition, they have their individual problems in sales, public relations, management, engineering and finance, and the solutions must be governed by factors outside as well as by those inside the industry.

As never before there is need for a plan and a program for dealing with social, economic and political conditions both locally and nationally. Each local utility must focus executive attention and action upon the external influences that affect the business. A much closer and more vigorous national correlation on industry-wide policies and acts to adjust the business to its environment is essential. This is the chief task for industry executives, however foreign it may be to their experience or distasteful to their temperaments. To the public the executive is the utility, and public relations responsibilities cannot be delegated.

Fortunately, the integration of the utility business with its local and national environment is a relatively easy task. The industry is not far out of step. There are only a few rough edges to smooth off before it will fit into its national niche. The program and plan can be made and applied to get both local and national results quickly and readily. All that is needed is executive performance on a local and national basis insuring that the external problems will be treated as competently and vigorously as the internal. This will be done and the industry will go forward.

Easy money but poor statesmanship

TAXATION burdens increase and the newest scheme is to tax electric power. Idaho, Vermont and South Carolina now have a half-mill tax on generated energy. Florida has a bill proposing a half-cent tax, and the Alabama Legislature has a bill to increase the present tax of 0.4 mill on hydro power to a half mill on all power.

It is significant that Vermont, Idaho, South Carolina and Alabama are large exporters of power. These new power taxes tend to stop the export of power, and this may force the state utilities to raise rates to all consumers to get sufficient revenue to carry their investment and the tax burden. At least these utilities will be affected and limited in their ability to extend service to farms and homes and to reduce rates, and the industrial development of these states will be handicapped seriously because of the relatively higher price of power that the law will bring.

Ample and inexpensive electric power is the greatest social and economic asset of any state or

community. Any taxation of electrical energy is multiplied enormously in its ultimate effects on social and economic wellbeing, and this apparently easy road to greater state revenues will prove to be one of the worst policies ever adopted. The states that adopt a policy of power taxation cannot compete industrially or socially with those that realize the value of electric service at low rates. Moreover, from the point of view of utilities, a half-mill power tax on top of an existing heavy tax burden on the properties is unfair and inequitable. The fallacy and economic evil of power taxation should be obvious even to the statesmen in state legislatures.

Cost allocations are not formulistic

PLEAS for more thorough allocation of service costs are by no means built fondly on the hope of developing a single and simple formula for all situations. There is probably no such thing, and even if there were, it would lack value by virtue of its very rigidity. Half the reason for the rapid expansion of electric service has been the active encouragement of new uses, each of which sooner or later affects the cost of rendering the already established services. Undue preferential treatment of new loads may easily enhance its own share of the cost burden and throw all its incremental benefits to other classes of service. This and other possibilities make cost allocation and rate making as much a matter of artifice and artistry as of statistical science. The desire for closer scrutiny of service costs is directed more at disclosing the factors of today which vitiate many of yesterday's accepted principles.

Rate making has never been on a value-of-service or all-the-traffic-will-bear basis. Nor can it be generally on a cost-of-service basis, because this gives too risky a prominence to mere increment costs. The happy medium falls between these unfeasible extremes. The choice will have to give due weight to peak responsibility, non-coincident class peak values, customer density, customer load factor, prospect of changed use attending any change in rates, careful estimation of the result of loads responding to inducement, and other items not susceptible to mathematical formulation of broad applicability. The need at the moment is to weigh the relative influence of these statistical cost and opinionative elements so that guesswork factors will give way to factors of safety superimposed upon factors of inducement. The goal of cost allocation is to produce minimum and uniform types of rates everywhere consistent with safety this year or any year on the visible horizon. The goal of load building is then to obtain all the business these rates will attract with the legitimate expectation that more volume will permit lower charges all around.

Cost allocation will have to change its pattern as often and as radically as aggressive load building disturbs the prevailing balance. Meanwhile the segregation and apportionment of charges is most likely to be responsive to the exigencies of commercial expansion if the detailed elements of service costs are analyzed, digested, disclosed and made a matter of discussion by the industry.

Security markets adjust values to meet equity changes

EDDYING and swirling, the tides and currents of political and popular protest over the alleged misdeeds of utilities repeatedly come back to the rock of "write-ups." Possibly no other practice in the management of operating and holding companies has incurred quite so much adverse criticism or has been the target of so much abuse. If there are "write-ups," say the critics, there should be "write-downs," and who, pray, ever heard of such a thing as that? Well, specifically, perhaps no one; but, nevertheless, "write-downs" do take place automatically and irresistibly. The cost to reproduce utility plant and equipment has gone down from 20 to 30 per cent; the market value of utility common stocks has shrunk 60 per cent—both since the peak period of labor, material, equipment and security prices.

Holders of common stock, by the very nature of corporate structures, must bear the first loss when adversity comes. It is then that security market prices reflect the new conditions. This is not a defense of or for "write-ups." These may possibly be either needless and ill-advised or necessary and proper. It is not obligatory to

take sides for the purposes of this discussion. But when the barrage of words and the fog of misunderstanding clear it is surpassingly evident that equities, earnings, prospects and money markets govern the trading prices and "values" of common stocks and "write-ups" lose significance. If the property depreciates in value, it is likely that the market value of the company's stocks will soon reflect it.

Left strictly alone, the stock market would establish its own "write-ups" and "write-downs" in virtually every case except where artificial corporate inflation was introduced for rate-making purposes. A combination which raised the rates to the ultimate consumer over those charged before the amalgamation would, it is true, be difficult to defend—and hard to find. The stock market is the great leveler.

Danger in forcing merchandising profits

AT THE present time, as all electrical men know, the ethical aspects of power-company merchandising are under close scrutiny. In no fewer than eleven states legislation was introduced this year to prohibit the utilities from selling appliances. In Kansas and Oklahoma it has become the law and there is still a possibility that other states will follow their lead. It is a poor time, then, for management to lose its perspective and jeopardize harmonious local trade relations by forcing unfair competition through any misjudged economy crusade.

It would appear that the financial minds behind some of the holding companies have been examining the red-ink items on the balance sheet involved in power-company commercial department expense. They have not realized that the sheet looks red because no credit is given for income from load value represented by appliances sold; so the edict has gone out to many power companies that the gross margin from merchandise sales should be sufficient not only to pay for merchandising operations but to support the entire commercial department as well.

Naturally the local sales managers are much perturbed. It is impossible to do a good general load-building job on the margin that will come from domestic appliance sales alone. It is impossible to put such pressure on appliance sales without running into destructive competition with the local dealers and precipitating trouble. And why should it be attempted?

The purpose for which the power company is selling appliances is to build up income from residence customers and improve the domestic load factor. All the other activities of the commercial department—the sale of lighting, heating, power, signs—are purely to build load. Then why this demand that profits on sales of household appliances should carry also every other kind of load building?

This kind of thing cannot be done by any other business. Nor can it be done by the power company. It isn't business. If domestic appliance sales are to pay all the cost of developing all types of load, then the merchandising operations of the average company will have to be trebled or quadrupled. This will mean intense pressure in the market place and warfare between salesmen. And then watch out!

Red Wing proves the case

RURAL service that involves an electric bill of $15 a month is profitable to a farmer. This is the conclusion of the latest report on the famous Red Wing experiment in Minnesota. Back in 1923 a co-operative effort was made on five farms to prove the value of electrical equipment. The farmers have purchased $16,667 worth of machinery and, with proper allowance for increased taxation, they have found that operating expenses for their farms are considerably lower today despite the increase in the electric bill. Thus for economic reasons only the Red Wing experiment pays, and the intangible elements of service and convenience are equally valid assets to the farmers.

In 1923 only three thousand farms in Minnesota had electric service as compared with the thirteen thousand now served, and the experience at Red Wing has been largely responsible for this great growth in rural service. Other states also have benefited from the Red Wing project and its experience data. Those in charge deserve congratulations for their early, continuous and very constructive contributions to rural service.

Master System Planning*

By N. B. HINSON and H. W. TICE

Chairman System Planning Committee and Operating Engineer, Respectively, Southern California Edison Company, Ltd., Los Angeles, Calif.

Has simplified protection, dispatching and communication.

Has localized the effect of short circuits and made short-circuit control possible, thus greatly improving stability.

Has adapted itself admirably to the requirements of a rapidly growing territory.

Has improved quality of service and reduced cost to the consumer.

SYSTEM planning as applied to the system of the Southern California Edison Company, Ltd., today came into existence in 1921 with the formation of the system planning committee. This committee began an extensive study of the system as a whole and laid out a comprehensive plan of system growth which has since been followed. From this was evolved the master system plan.

In a territory growing as rapidly as southern California, it has been necessary to make plans for transmission and major substation systems which will care for the ultimate development in the territory as nearly as can be determined, and then to carry this program out as the load grows rather than set definite dates at which certain developments will be made. A five-year program, year by year, is outlined for transmission lines, substations and generating plant additions. With a change in the rate of growth of any particular area it is possible to move up or postpone any section of the work.

Rate of growth

In the past ten years the population in the 55,000 square miles of territory served has increased 115 per cent and the number of electric customers 150 per cent. From a study of population increase it is found that southern California increased 800 per cent during the past 30 years, as compared with 65 per cent for the country as a whole. This gives some idea of the tremendous burden placed upon utility companies in keeping pace with growth of load and the necessity for a comprehensive system plan.

To meet present demands there is now a total hydro capacity of 478,000 kw. and 462,000 kw. of steam capacity, or a system total of 940,000 kw. It will be seen that the generating capacity is about equally divided between steam and hydro. Big Creek and Long Beach steam plants, the two major power sources, are connected by 220-kv. transmission lines approximately 275 miles long. The great bulk of the load is located within 25 miles of the main steam station at Long Beach, and it is in this area that the load is increasing most rapidly. The table on page 946 shows the horsepower connected for the different classifications of service for the end of the year 1930.

Master system plan

The major plan for the general system consists of a 220-kv. transmission backbone extending from the Big Creek hydro plant in the north to Long Beach steam plant in the south (see map). This consists of three separate transmission lines practically the total distance of 250 miles. Near the lower end the major transmission extends to the west and a new line is being built to the east corresponding to the inverted letter "T." Along this transmission network there are seven major stations stepping down from 220 kv. to 66 kv., with an aggregate capacity of 1,018,000 kva., the largest station having a capacity of 235,000 kva. and the smallest 75,000 kva. These stations supply eleven separate and distinct load centers, interconnected on the 220-kv. system only. Practically all transformers are single phase, 25,000 kva.

Sub-transmission voltage used is 66 kv., all of the lines being overhead and arranged as radial feeds from the major stations. Getaways from the major stations are multiple-circuit steel towers, wood-pole lines being used in a few cases. The general scheme is at least two parallel lines over separate routes to a station, and for stations exceeding 15,000 kva. a third line from some other station in the group. Many of the smaller stations also have a third line.

Distribution substations vary in capacity from 3,000 kva. in some of the sparsely settled agricultural territory to 30,000 kva. in the metropolitan areas. They are practically all single-bus with a transfer bus, except in some of the very important stations, where double-bus, double oil switches are employed. These stations step from 66 kv. to 16 or 11 kv. and in certain sections to 4 kv. All transformers are single phase, standard sizes being 1,000, 2,000 3,000 and 5,000 kva.

**Based on report presented before the power systems engineering committee meeting at St. Louis, Mo.,*

There is another class of distribution substation stepping from 16 or 11 kv. to 4 kv. for supplying built-up cities and towns. These vary in size from 750 kva. to 12,000 kva. and from some simple outdoor stations in the small cities to brick, concrete or residential type stations with complete underground getaway, depending upon the character of the territory in which they are located. All transformers are single phase, standard sizes being 250, 500, 1,000 and 2,000 kva.

Distribution voltage for all of the territory excepting residential and business areas is 16 or 11 kv. The general scheme is radial feeds to the load, but in the industrial districts the lines are gradually being rearranged into multiple circuit or loop service to insure greater reliability of service. For sub-distribution four-wire, 4 kv. with radial feeds is in use.

Voltage regulation is accomplished at the major 220- to 66-kv. stations by means of 400,000 kva. in condenser capacity. Condenser sizes range from 15,000 to 60,000 kva., the most recent installation being outdoor, hydrogen cooled. Three-phase induction regulators are used on all 4-kv. service. Allowable voltage range is from 3 to 5 per cent at consumer's stations on the 16- and 11-kv. circuits. On the 4-kv. circuit the regulation holds the variation to the consumer between 1 and 3 per cent.

The reserve transformer capacity available at the substations is approximately 35 per cent of the peak. This reserve capacity can be utilized at any point throughout the system during emergencies by interconnections through the station tie lines, transferring load from one group to another. In distribution substations with two or more transformer banks no spare transformer is provided. Where one bank only is installed a fourth or spare transformer is provided in sizes of 1,000 kva. or larger. This transformer is installed so that, by the addition or two more, a second bank will be available.

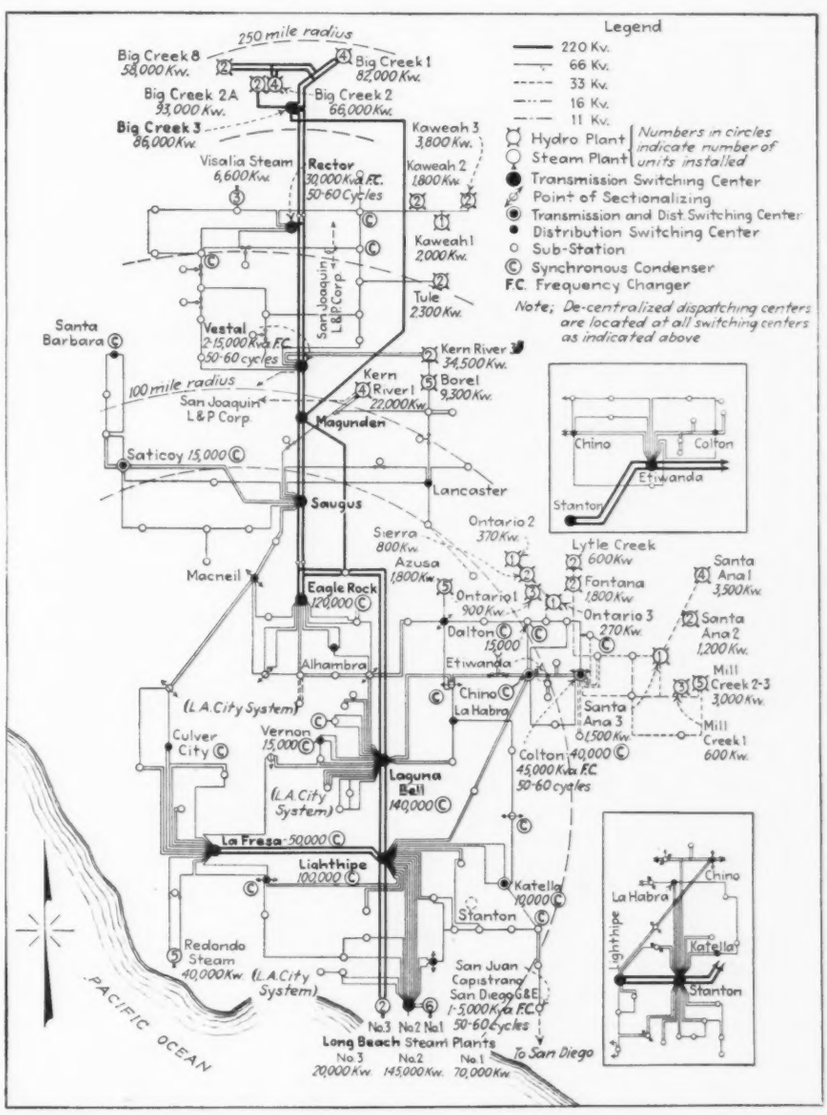
In the industrial area stations are operated in parallel with each other through heavy distribution ties so that one station can give emergency service to the other in case of trouble. This scheme is carried out automatically in the territories supplying oil refineries where an interruption may cause serious inconvenience to the consumer.

There are three types of bulk power customers: First, municipalities that purchase all their power wholesale and redistribute, the smaller ones taking delivery at 23 or 4 kv., the larger ones at 16 or 33 kv. The second group consists of the railways which take all their delivery at 16 kv. through a number of delivery points which have been established. The third group consists of large industries, such as the cement and rubber companies, with a connected load of approximately 8,000 hp. or more, which are supplied direct from the 66-kv. system, with a substation and transformer set-up similar to other distribution substations. The company owns all of the equipment down to the low-tension bus. There are a great many smaller industrial jobs of from 1,000 to 8,000 hp. supplied from 16- and 11-kv. lines, for which are installed simple outdoor substations similar to the company's own distribution stations.

System investment

In all there are 820 circuit-miles of 220-kv. transmission lines, 2,084 circuit-miles of 66- and 33-kv. subtransmission lines, 5,585 circuit-miles of 16- and 11-kv. high-voltage distribution lines and 8,900 circuit-miles of 4-kv. and secondary low-voltage distribution lines.

Average cost for major 220 to 66-kv. stepdown sub-



Schematic diagram of transmission system of Southern California Edison Company, Ltd., showing major load centers

stations is $29 per kilovolt-ampere of installed capacity or $34 per kilowatt of peak. This cost includes condensers as well as all other equipment. The average cost for sub-transmission, 66-kv. lines is $22 per kilowatt of system peak. Average cost for distribution substations, 66 to 16 and 11 kv., is $22 per kilowatt of system peak. Sixteen and 11 kv. to 4 kv., $8 per kilowatt of system peak, or a total of $30 per kilowatt of system peak for distribution substations. The average cost for distribution lines, including 3½ per cent underground, is $34 per retail horsepower connected or $108 per kilowatt of system peak. The total load area investment is $60 per horsepower connected, or $171 per kva. of capacity installed at the 220/66-kv. step-down substations, or $231 per kilowatt of system peak. The total investment in load area can be predicted by using the approximate figure of $60 per horsepower times the projected horsepower to be connected in the area.

The following investment figures are given in two different ways, one breakdown being per kilowatt or kilovolt-ampere capacity of generator or substation, the other per kilowatt of system peak. It is impossible to classify sub-transmission and distribution lines in the first classification:

Investment per kilowatt of capacity:	
Steam	$84.00
Hydro storage	223.00
Hydro base	226.00
Average for all generation	152.00
Subs at generating stations	6.00
220-kv. transmission lines	37.00
220- to 66-kv. subs.	29.00
Interconnections and tie facilities	6.50
Investment per kilowatt of system peak:	
Generating stations	$234.00
Generation subs.	10.00
220-kv. transmission lines	37.00
220-kv. subs.	34.00
66-kv. sub-transmission lines	22.00
66-kv. distribution subs.	22.00
16-11 kv. distribution subs.	8.00
Distribution system (overhead and underground)	108.00
Total of	$475.00

There are other items in service on the system, such as telephone lines, general store, transportation equipment, etc., which are not included in the above.

The average of economies for all plants is: Hydraulic turbine units, 80 per cent; hydraulic impulse units, 70 per cent; steam plants, 26 per cent.

The 220-kv. transmission system, including the step-up and step-down transformers, has a loss of 8½ per cent with 25 per cent of the load being carried by steam and 7 per cent loss with 50 per cent of the load on steam. The standing reserve capacity in generation is 53 per cent of the peak load. This seems very high value, but is due to the fact that it is necessary to have additional steam to take care of low-water periods or years. As for running reserve, when Big Creek is carrying the reserve the minimum allowable margin is 75,000 kw. When steam is carrying the reserve the margin may drop to 50,000 kw., but in no case is it allowed to fall below 10 per cent of the peak load. Steam capacity is 462,000 kw. and hydro capacity 478,000 kw.

Economy of master plan

The over-all economy of the master plan of system layout is brought about by the fact that all work is planned to fit in with the ultimate scheme of major load centers. All radial sub-transmission lines and extensions are routed past a given location that has been selected as a future load center. This substation may have to be built any time within the next two to five years and in some cases as much as ten years, depending upon the rate of growth of the particular area. These lines are then cut in two and brought into the new load center to form a radial sub-transmission system.

Load Growth for Five-Year Period

	Horsepower Connected End of 1930	Per Cent of Total 1925	Per Cent of Total 1930	Per Cent Increase in Hp. Connected 5-Year 1925-30	Per Cent Increase in Kw.-Hr. Consumed 5-Year 1925-30
Lighting	520,000	26	21	65	115
Agricultural	370,000	18	15	70	70
Industrial	665,000	24	27	120	110
Resale	425,000	15	17	120	55
Railway	145,000	11	6	7	0
Electric cooking	325,000	6	14	450	315
Total	2,450,000	100	100	99	69

Such plans permit the early acquisition of substation sites, rights-of-way for transmission lines, etc. This same scheme is followed out with regard to distribution stations fed from the 11- and 16-kv. distribution lines. Additions to capacity are readily made to such a system as the load grows. This system also eliminates the difficulty encountered in limiting short-circuit kva. in closely interconnected systems, thereby resulting in considerable savings in first cost of oil circuit breakers of high interrupting capacity and minimizing trouble due to short circuits.

Such a system readily adapts itself to changing load conditions. With increasing size it retains all of its simplicity, thereby making for ease of operation. It lends itself to standardized types of substations, which again means a saving in investment. Within any group area, distribution stations and lines can be operated in parallel, which increases reliability of service and decreases the cost to serve a particular area. The tendency in distribution stations is toward full automatic operation, unattended, with alarms back to centrally located points. This also is facilitated by the group operation.

Standardization of equipment and practices

Standardization of equipment units is carried out along all lines to a very large extent. Distribution and transmission lines in all districts are built according to a book of standards. Although the system is broken up into six major groups, all use the same standards of construction in all lines and the same standards of operation.

The 220-kv. stations are all standardized as to the size of transformers and condensers and all have double bus on both 220 and 66 kv. The 220-kv. transmission lines are of two general types, single-circuit horizontal and double-circuit vertical.

Sub-transmission lines leaving the major stations are practically all on multi-circuit steel towers of six- or twelve-circuit capacity, and where constructed on wood poles are practically all single-circuit vertical with an 11- or 16-kv. distribution circuit occupying the opposite end of the crossarm.

Distribution substations are of four general types which have become more or less standardized. The tendency in generating plants is toward larger and larger units with unit operation of generator and transformer bank, switching being done on the high-voltage side only. In a subsequent article other elements of the master system plan will be discussed, including dispatching, protection and communication.

Insulating Oil Reconditioned at Minimum Expense

By J. COLEMAN JONES
Transmission Engineer
Florida Power & Light Company, Miami, Fla.

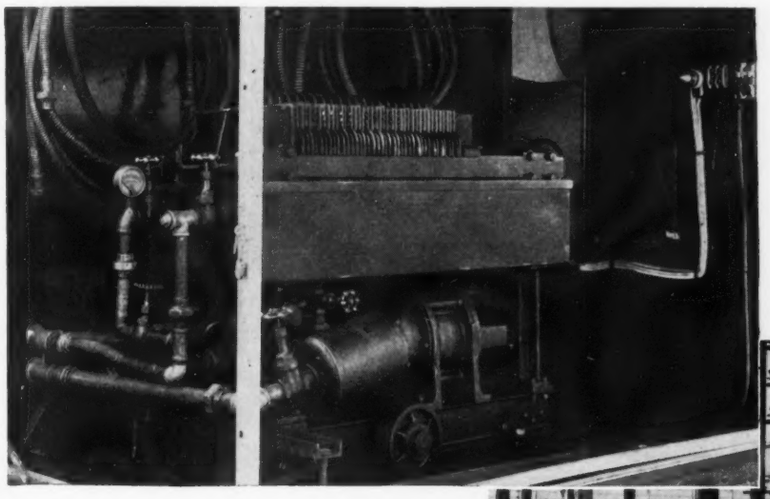
To insure proper maintenance of the oil used in high-voltage transformers and oil circuit breakers and at the same time reduce the cost of reconditioning the oil, the transmission department of the Florida Power & Light Company has developed an oil trailer. This reduces labor and equipment required for handling large quantities of oil in high-voltage transformer and oil circuit breaker maintenance. A 10-ton low platform trailer, with tires of sufficient size to comply with state highway requirements, is used. On it an oil tank 7 ft. in diameter and 9½ ft. long was built, with a partition in the middle. Baffles within the compartments were provided to minimize the movement of the oil while the trailer is in motion. Besides being equipped with manholes and breathers on the top of each compartment, 2-in. pipe connections were installed at each end at the top and bottom of the tank. The tank was then mounted on skids which were bolted to the floor of the trailer.

A sheet-iron housing at the rear incloses a 12-in. blotter type filter press and built-in drying oven. One end of this house is divided, the lower part being removable and the upper hinged at the top. When raised this top section acts as an awning for the front of the house. The left side contains a door hinged at the back and the right is permanently closed. This arrangement gives free access to all parts of the filter press and valves. Racks for hose and an oil gage calibrated in gallons are located on the back side of the housing, as shown. The press rests in an oil tray to prevent drippings from getting on the floor and tires of the trailer.

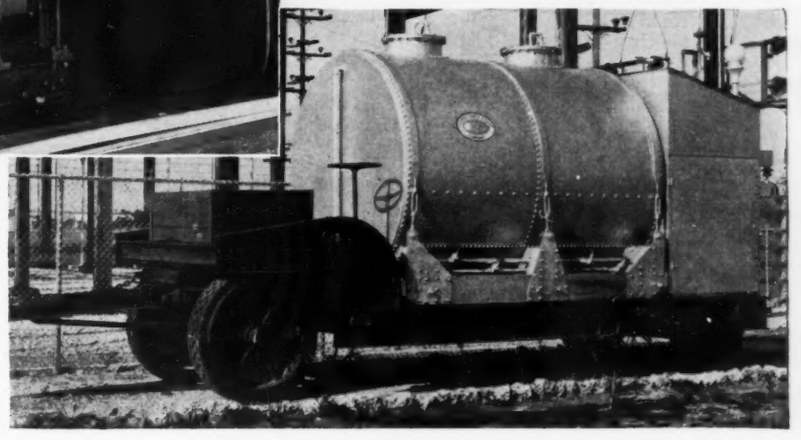
A weatherproof box is mounted on the front above the wheels for tools, pipe, couplings and filter paper.

The use of this equipment materially reduces the time, equipment and labor required for inspecting oil circuit breakers, flushing transformer windings, repairing transformers and transporting oil. The two compartments make it possible to carry clean and dirty oil or transformer and switch oil at the same time. It also reduces the number of permanently installed tanks, as oil can be easily moved with the trailer. The trailer can be spotted in one location and used on several pieces of equipment by adding extra lengths of pipe to the flexible hose. In most cases it is better than the permanently installed tank and filter house, as it can be operated closer to the equipment being inspected.

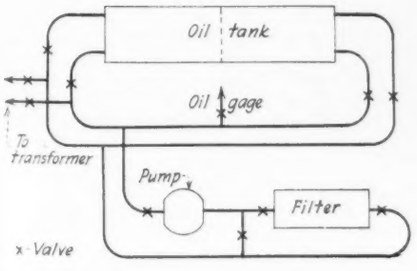
The tank and housing can be removed from the trailer by five men in three hours and the trailer is then available for hauling other heavy equipment. The trailer and empty tank can be moved on level ground by a light model ¾-ton truck and is readily handled by a 1½-ton truck when loaded.



Filter press compartment



Oil maintenance trailer includes two 1,400-gal. tanks and filter press



Double tank permits thorough reconditioning of insulating oil

Piping is brought to the filter press from the tank, with connections for the leads to the transformer or oil circuit breaker on the outside. It is possible to circulate oil in one tank, between the two compartments, within the transformer, or to use the press as a pump only for moving the oil. With this arrangement it is possible to filter oil regardless of weather conditions.

Wiring Specifications for Dwellings

Recognizing the need for a standard specification outline on electrical wiring in the ordinary construction of home and apartment dwellings, the Electric Association (Chicago) produced such an outline under the direction and with the assistance of the joint committee on materials and methods of the Chicago chapter, American Institute of Architects, and the Illinois Society of Architects. The work does not cover nor touch upon the idea of wiring adequacy in any manner. It is intended to present simply the logical outline of an electrical specification from the service entry to the last outlet, and it is hoped that its use will result in simpler, clearer and more concise specifications to obviate in great degree the misunderstandings arising from present statements of requirements, many of which are poorly and meagerly prepared.

The following is not a complete transcript of the specification outline, but is merely a résumé of it, item by item. It should perhaps be pointed out that the outline does not contain any reference to any other types of wiring than those mentioned below and does not provide for the inclusion of wiring systems that may later become acceptable to national or local codes. In reference to service connections, it recognizes no other underground connection than that in duct. The restriction of wall switches to the tumbler flush type may be onerous, as may also the requirements that all materials shall be definitely specified by the makers' names.

But however one may criticise certain details of this outline, one must admit that its compilation is a long step forward in the direction of reason in a much disputed and confused field. The electrical industry should give much credit to the Electric Association for this very worth-while accomplishment.

Standard Specifications of the Electric Association

The outline opens with a general clause that states that the specification is to be considered as a part of the **electric wiring contract.**

The scope of the outlined specifications includes all that is necessary for a complete wiring system, including service switch, feeders, distributing panels, circuit wiring, plug receptacles, local switches, bells, telephone conduits, etc.

The third paragraph deals with code rules and states that work shall be done as required by the National Electrical Code and local inspection department. Contractor obtains and pays for approval certificates.

All materials used shall be approved by the National Board of Fire Underwriters and by local authority. When no make or brand is specified or where the expression "equal to" is used the contractor must notify the architect of the make or brand to be used and receive his approval before any such material is installed. A parenthetical remark in this paragraph instructs the architect to specify materials by manufacturers' names.

The contractor shall warrant to make good any defects in his workmanship or materials which shall develop within one year of the date of acceptance of the installation.

The architect is advised to obtain information on the system of electric service offered by the local utility; that is, its voltage, frequency, number of wires and whether alternating or direct current, and to include this information in the specification. The utility is to be asked to inform the architect in writing as to types and locations of services.

The seventh paragraph of the specification designates the location of the service entrance.

In dealing with **outlets per circuit,** the outline informs the architect that a circuit must be installed for every thousand square feet of floor area and in no more than four rooms and that circuits are to be protected by a 15-amp fuse. An outlet is understood to mean an outlet of the permanent type to which a fixture, convenience outlet or similar device is to be connected.

All convenience outlets in the dining room, kitchen, pantry and laundry shall be connected to a separate circuit known as an **appliance circuit.** This circuit shall be installed with No. 12 wire, shall not have any lighting outlets connected to it, its capacity may not exceed 1,000 watts and all its receptacles shall be of the single polarized type with lettered plates.

Upon request of the architect, contractor shall submit in duplicate **wiring diagram** showing circuit distribution, service location, cutout cabinets, meters, conduit sizes, number of conductors in each conduit and size of conductors.

In reference to **rigid conduit,** the outline presents definite requirements in regard to the installation, proper handling and treatment of this material.

The following paragraph refers to **armored cable** and states that it may be used where permitted by local codes. Requirements for handling and installing this cable are given.

Where permitted by local code, **nonmetallic sheath cable** may be used. Methods for handling and installing this material are specified.

Branch circuits of 100 ft. or longer shall have **conductors** no smaller than No. 12. Twenty-five per cent Para rubber is required in insulation.

No **wiring** shall be installed until completion of other construction work that might damage it. Wiring shall be continuous and without splices except in outlet boxes and it shall be polarized with a white-covered wire for neutral. It is recommended that colored wires be used to identify circuits.

The making and insulation of **splices** are specified.

Conduit systems shall be connected to **ground** through the water-piping system in accordance with national and local requirements.

Service switch and mains are specified to be of 60 amp. installation. Mains are to be not smaller than two No. 8 wires in ¾-in. conduit.

The contractor shall install **service connections** from the service switch to the point designated by the local utility.

Provision for meter is to be made as required by the local utility.

The size of the **feeder** from the service switch to the distribution panel is to be figured same as the entrance service if there is only one distribution center. If there is more than one center, feeders shall be sufficient to confine the voltage drop at full load of all circuits to not more than 2 per cent between the service switch and the farthest lamp.

The distributing **panelboard and cabinet** shall be of the safety front type of approved design.

Distributing panels shall be fully equipped with **fuses** and the contractor shall furnish a number of fuses 25 per cent in excess of the panel installation. Branch circuits shall be fused to 15 amp. and appliance circuits to 20 amp.

The types of **outlet boxes** to be used in all the various outlets are specified.

Definite requirements in regards to **position of outlets** are given.

Wall switches shall be tumbler flush type.

Covering **plates** for all types of outlets are specified in detail.

Convenience outlets shall be dead-front duplex type.

Definite specifications on **drop-lights** are included.

Heater switch, pilot light and receptacle shall be the equipment in all heating device outlets.

Complete requirements for the installation of **call-bells,** etc., are included in the outline.

Service conduits for telephone wires are completely specified.

The contractor shall do all the **cutting and repairing** that is made necessary by the wiring installation.

The outline concludes with a test requirement that states that the installation shall be entirely free from grounds and short circuits except for the required ground connections.

Accident Prevention Pays Dividends

If considered purely from a mercenary standpoint and entirely aside from its humanitarian aspects, does accident prevention work pay dividends? This was one of the subjects studied by the accident prevention committee of the Pacific Coast Electrical Association during the present year.

In gathering data every large power company in California was contacted, but it was found that only two companies had records and costs over a sufficiently long period of time to be of any value. Of these, complete cost data were secured from only one, the Los Angeles Gas & Electric Corporation. The accompanying tables should receive the careful consideration of the management of every utility company. Table I gives much valuable data on accidents in addition to total cost. Table II is a breakdown of these costs giving some unit costs of great interest and value. From Table I it will be seen that the average yearly cost of accidents for the three-year period prior to 1926, before safety work was begun, was $76,636. For the next three-year period under a safety program the average annual cost dropped to $41,651, or a saving of $34,985. For the first ten months of 1930 total cost of accidents had dropped to $14,406, showing the cumulative effect of accident prevention work.

The total cost of maintaining a safety department in this company is about $10,000 a year. Based on the two three-year periods, with and without safety work, it will be seen that an investment of $10,000 a year produced a saving of $34,985. Does the management of any utility need further proof that accident prevention work pays dividends?

Table I—Accident Chart 1924-30

Los Angeles Gas & Electric Corporation

	Three-Year Period Without Safety Work			Three-Year Period With Safety Work			Ten Months
	1924	1925	1926	1927	1928	1929	1930
No. of cases reporting to doctor	1,038	1,036	945	557	343	344	221
Total lost-time accidents	518	489	416	286	189	169	96
Fatalities	4	2	5	7	1	2	1
Days lost account of accident	19,908	22,232	14,155	4,325	10,336	3,059	1,626
Serious accidents causing lost time of fourteen days or more	103	101	72	66	51	35	22
Ratio lost time accidents to employees	1–7	1–7	1–8	1–12	1–16	1–17	1–33
Lost time accidents per 100 employees	13.3	12.6	12.0	7.9	6.0	5.5	3.0
Days lost per 1,000 days worked	17.1	18.9	14.0	4.0	10.9	3.4	0.1
Average time lost per lost time accident	38.4	45.4	32.5	22.1	54.6	18.1	16.9
Average number of employees	3,819	3,861	3,446	3,576	3,105	3,053	3,195
Medical and compensation costs	$79,879	89,645	60,386	63,564	30,152	31,238	14,406
Average cost for three-year period	$76,636			$41,651			

Table II—Accident Cost Chart 1924-30

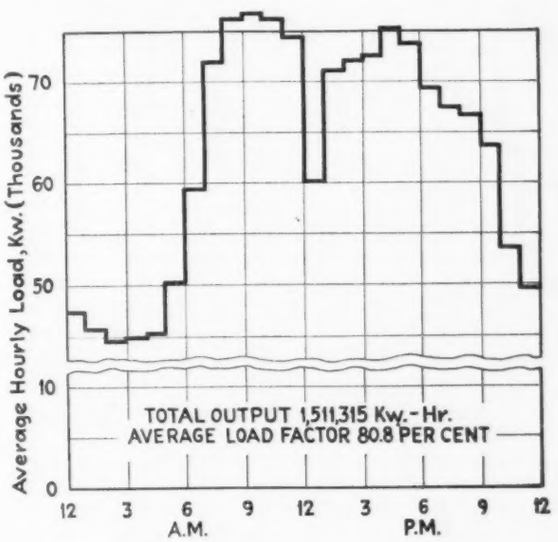
Los Angeles Gas & Electric Corporation

	Prior to Active Safety Work			After Present Safety Work Began			Ten Months
	1924	1925	1926	1927	1928	1929	1930
Compensation cost	$50,943	$51,552	$39,175	$46,947	$17,327	$18,129	$9,076
Hospital cost	8,984	18,792	6,190	6,009	5,023	5,475	2,114
Medical	19,948	19,308	14,905	10,606	7,801	7,544	3,216
Total cost	79,875	89,652	60,270	63,562	30,151	31,148	14,406
Cost per accident	76.95	86.50	63.77	114.11	87.90	90.54	60.66
Accident cost per each employee	20.91	23.21	17.49	17.77	9.71	10.20	4.50
Average cost per accident over a period of six years, prior to 1930							$83.19
Cost for 1930							60.66
Cost of accident per person employed, average of six years prior to 1930							16.54
Cost for 1930							4.50

▼

Maintains Monthly System Load Factor of 76.3 per Cent

What is thought to be an outstanding record for maintaining a high load factor is that of the Central Maine Power Company, a hydro-electric system supplemented somewhat with steam generation serving thirteen of the sixteen counties in Maine. This company generated a total output of 38,862,420 kw.-hr. during January and maintained a load factor of 76.3 per cent.

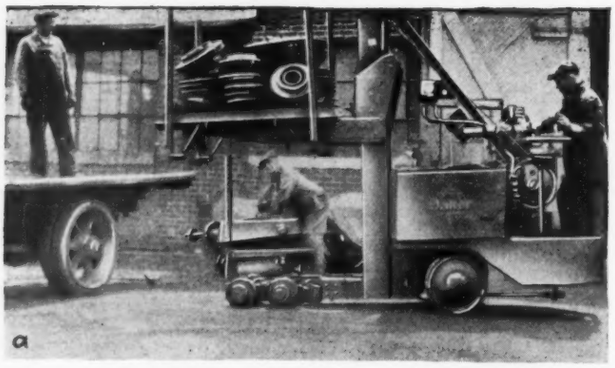


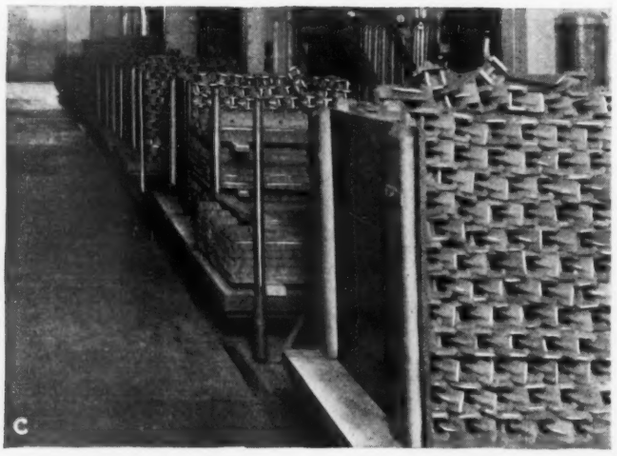
Central Maine Power Company load curve, February 13, 1931

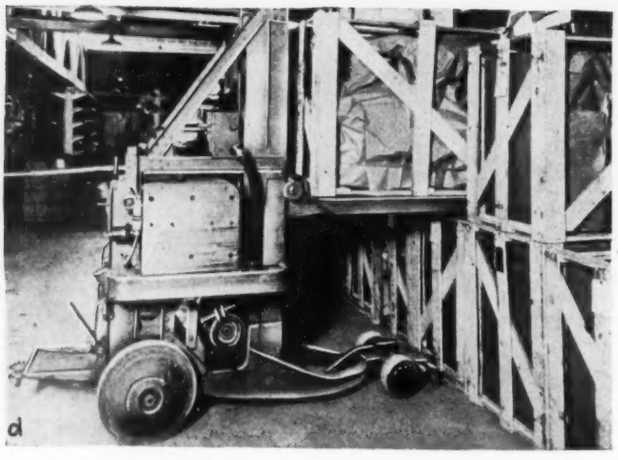
This exceptionally fine load factor is directly attributable to the mill load, much of which is on a 24-hour basis. Even from midnight to 5 a.m. the load holds up extremely well, rarely dropping below a demand of 37,000 kw.-hr., or around 59 per cent of the average hourly output; one paper company uses 15,000 kw. 24 hours a day. This is the largest single demand made by any one mill.

The accompanying illustration shows the combined load curve for February 13, a typical day.

Since the mill load is practically uniform in the morning and afternoon, the extra demand for power in the morning hours is attributable in part to the domestic use, a considerable portion of the housewife's use of electrical appliances coming at this time. The total output for this day was 1,511,315 kw.-hr., 461,000 kw.-hr. being generated by steam at the company's floating power ship the *Jacona*, which has a capacity of 20,000 kw.







Material Handling

Economies of electric truck operation in utility service.

Typical examples of convenience, economy and safety.

Balance sheet proof of values.

ELECTRIC power companies are, of necessity, in other businesses besides the generation and sale of power. They sell (and handle) millions of dollars' worth of refrigerators, washing machines, lamps, ranges, water heaters, vacuum cleaners, etc., yearly. They carry on reclamation operations, as a side line, which would make a scrap metal dealer turn gray (or green with envy as the case may be). Used wire, discarded cable, waste paper, burned-out bulbs, transformers, poles, insulators, meters—how are these handled? The very system which transmits and distributes energy so economically requires extension, improvement, replacement year by year. What of the handling of material

(a) Street truck unloading to electric truck for utility warehouse delivery
(b) Scrap wire and cable delivered to storage
(c) Warehouse stores on skids to facilitate electric truck handling
(d) Incoming electric ranges can be stacked and stored by use of high lift truck
(e) Temporary attachment on truck for handling pig lead recovered from cables

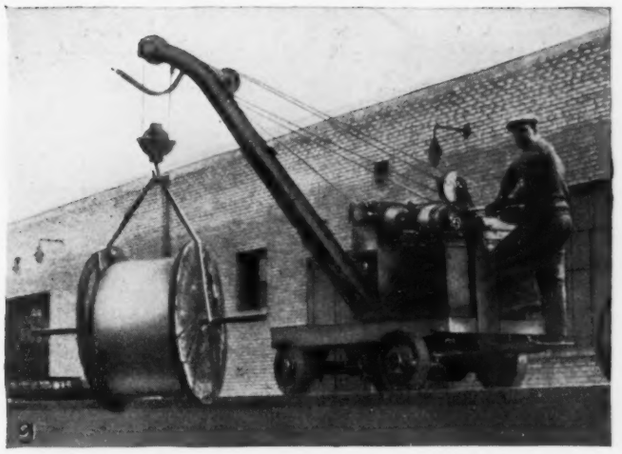
Costs Cut by Electric Trucks

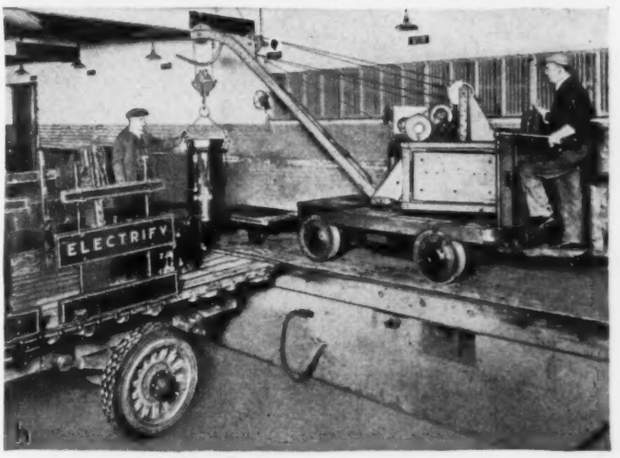
By CHARLES B. CROCKETT
New York City

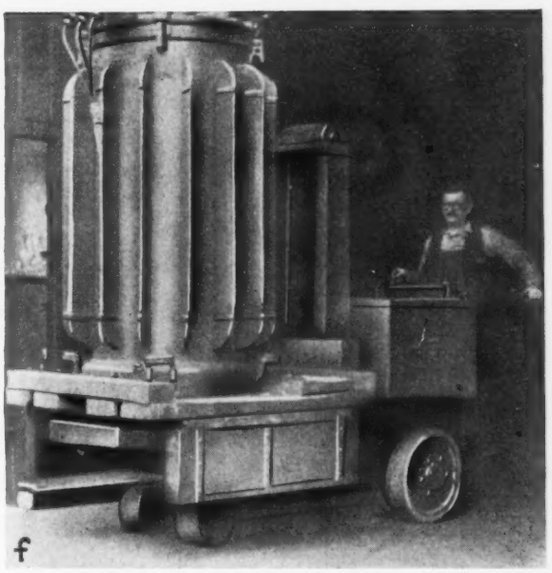
and supplies for the overhead line crews, the underground gangs, the emergency service crews?

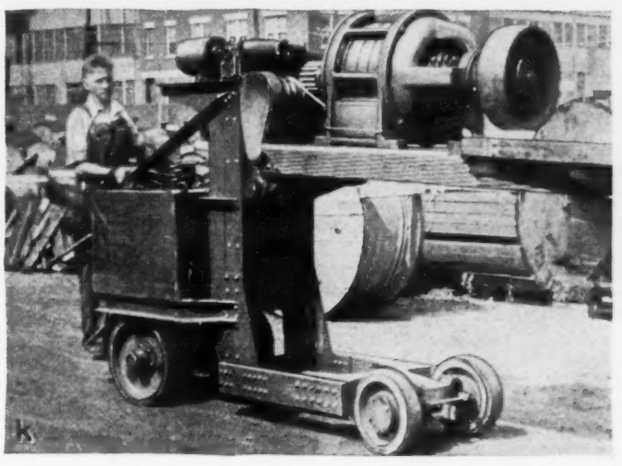
Manufacturing establishments appreciate the influence which mechanical methods have on production and production costs as well as on the direct labor cost of the handling itself. The handling methods of the electric power company have a marked effect on the storage space required, the continuity of service, damage to equipment and injury to men. Furthermore, the electric power companies, which are the most successful in developing different uses for their product among their customers, are the ones which practice what they preach and make every possible use of electricity in reducing their own costs.

Nothing is more characteristic of the handling prob-









(f) Quick loading of equipment to meet emergency calls is facilitated

(g and h) Crane trucks handle cable reels and transformers readily

(j) Cable reels are handled with safety by using trucks as tractors

(k) On construction jobs the trucks save time and money and increase safety

lems of electric utilities than the tremendous diversity of products which have to be handled, and it is therefore to be expected that we find these power companies are widespread users of electric industrial trucks. At the Bellevue warehouse of the Detroit Edison Company a wide variety of reclamation and handling operations are carried on with the efficient help of two 5-ton electric high-lift (or tiering) trucks. Street trucks are unloaded in eight to ten minutes, and as a heavy motor truck costs 6 to 8 cents a minute while standing still the economy of fast unloading and loading is apparent.

Scrap wire and cable arrives by truck with the wire on skids. The industrial truck transfers the skids to the furnace and later compresses the reclaimed wire, by raising the platform of the truck against a fixed support, and then moves the load to an outgoing freight car. When the wire is finally in the car the electric truck packs it into place, so that cars leave the warehouse with loads as high as 80,000 lb. The company advises that by this method the labor cost of reclaiming wire has been reduced 90 per cent. Another problem is the handling of bales of waste paper from compressor to cars. In this operation the trucks have cut the cost 60 per cent.

One of the trucks with a temporary attachment handles pig lead (recovered from cable) in 6,000-lb. units. The trucks easily negotiate the ramp to the flush-loading dock and the loading cost has been dropped from 9 cents per ton to less than 2 cents per ton. One of the greatest percentage savings has occurred in the operation where the brass bases of lamp bulbs are reclaimed. The broken bulbs had formerly been shoveled into barrels and hand trucked to a dump body truck, which disposed of the broken glass. By replacing the barrels with a skid box and using the electric truck, the truck operator now completes the handling and loading in 0.5 man-hours, whereas the best former record had been 6.5 man-hours; the reduction, therefore, was 92½ per cent of the former cost.

Much of the material in the actual storeroom is handled by the electric trucks and is stored on skids, which eliminates rehandling. Heavier pieces are dropped on the truck or skid by overhead crane and moved by the electric truck.

With the increase of merchandising activities, the question of storage space confronts many electric utilities. Public Service Company of Northern Illinois has utilized the high-lift or tiering truck in its new Maywood warehouse. Ranges and other material are now unloaded from motor truck, transported to storage and stacked three high by the use of this type of truck. This company now uses two 2,000-lb. low-lift trucks, two 6,000-lb. high-lift trucks and one 3,000-lb. crane truck. It is found that the low-lift trucks are in use seven hours per day, the tiering trucks five hours and the crane approximately three hours. Over a period of years the operating cost of these machines has been $1.54 per day and the stores department says that their useful life is ten to twelve years.

Although only used for an average of three hours a day, the crane truck is considered one of the most valuable pieces of equipment. The general storekeeper called attention to the value of this truck in the quick loading of a motor truck in answer to an emergency call. Due to the fact that many changes occurred when the new warehouse was occupied, it was possible to secure exact saving figures for the trucks. The officials of the Public Service Company of Northern Illinois state, however, that out of a total saving of $125,000 per year a considerable, if not the major, portion of this saving is definitely attributable to the use of these machines. Average inventory at this location runs in the neighborhood of $400,000, and faster handling has made it possible to reduce the quantities held in stock. The use of trucks and skids has improved service for line crew trucks as the material ordered before 4 o'clock each day is assembled on skids and moved to the line trucks when they come in.

At the central stores building of the Philadelphia Electric Company, located at 23d and Market Streets, an accurate record has been kept of the men and time required for certain handling operations with and without the use of electric lift trucks. The following are typical of the savings effected in the hundreds of different items they are called upon to handle every year:

Washing Machines

	Old Way	New Way	Saving
Labor	5 men	1 truck, 1 helper	3 men
Space	Stored one high	Stored three high	67 per cent of floor area

In one five-day period the storeroom was called upon to unload and store 22 carloads of refrigerators, the cars holding from 42 to 75 refrigerators each. With the use of one truck full time and one truck half time and three men in the car and two on the storage floor the 22 cars were unloaded in five nine-hour days without resorting to overtime. Here is the record of costs:

Unloading 22 Carloads of Refrigerators

	Days		Hours per Day		Cents per Hour		
5 men	5	at	9	and	40	=	$90.00
1 truck operator	5	at	9	and	50	=	22.50
1 truck operator	5	at	4½	and	50	=	11.25
1 truck	5	at	9	and	30	=	13.50
1 truck	5	at	4½	and	30	=	6.75
Total cost							$144.00

Cost per carload = $6.55

In emergency service the question of time saved is even more important than labor costs. The general storekeeper called attention to the time required for handling when a transformer is burned out:

Loading Two Transformers on Motor Truck

	Old Way	With Electric Truck	Saving
Number of men	4	2	2
Time, minutes	50	12	38 (76%)
Man-hours	3.33	0.4	2.93 (88%)

When the convenience of customers and the length of an outage is involved it is easy to see in the above that the possible shortening of outage time by 38 minutes is of no small importance.

The central-station storeroom is confronted with various handling tasks of an intermittent nature where the object to be moved is so heavy that it requires a gang of men. The Philadelphia Electric Company had such a problem in the unloading of cars of cable reels. Reels weighing 4 to 6 tons each were received in carload lots, averaging ten reels to a car. It took a gang of eight to ten men to push one of these reels

and there was always the chance of a man straining himself or suffering a crushed foot if the reel got away from the gang. Accident insurance companies have compiled figures which show, first, the high percentage of hernias suffered from moving material by hand and, second, that the majority of industrial accidents to unskilled labor are attributable directly or indirectly to handling.

A good method has been adopted by the Philadelphia Electric Company for moving these reels. A cable sling is attached to the reel and the other end attached to a towing hook on the lift platform of the truck. The reels can then be pulled through the warehouse by the truck acting as a tractor. The time and man-power saved in unloading a car of 10 reels are shown as follows:

	Hand Method	Electric Truck	Savings
Men required	9	Truck and driver, 2 helpers	6
Time required, hours	5	2	3
Man-hours	45	6	39

In addition to the direct saving effected in the handling, this increased efficiency is passed on down the line to other departments. The general storekeeper spoke of the service to line crews as follows: "In order to have our line trucks ready to go out promptly in the morning the necessary materials to take care of the day's work for each line gang is put into the proper motor truck during the night. Formerly we kept three or four hand trucks busy on this job during the evening, using three men to a truck, or on the average of about ten men on this work. One man with the electric now does this entire job."

An important consideration in the use of any mechanical device is the expense of maintaining and operating the equipment. The electric industrial truck shows up as favorably from this standpoint as it does from the standpoint of things accomplished. Again we quote from the experience of the Philadelphia Electric Company: "Our records for last year show that the trucks in our central stores building average 558 kw.-hr. per month or (at 2 cents per kilowatt-hour) $11.16 per truck for power and only $1.25 per truck per month for repairs. This is especially favorable considering that this includes our oldest truck, which had been in service for nine years on June 16, 1930.

Figuring all costs, we secure a monthly figure as follows:

Total Cost per Truck per Month

Truck depreciation, $2,000 ÷ 114 mos.	=	$13.90
Battery depreciation, $100 ÷ 12 mos.	=	8.33
Interest on investment at 6 per cent	=	13.50
Power, 558 kw.-hr. at 2 cents		$11.16
Maintenance and repairs		1.25
Total truck cost		$48.14

From the above it is seen that an electric truck's total cost is approximately 60 per cent of the cost of a laborer at 40 cents an hour and on an average it will save four to eight men. In terms of return on investment a truck costing $48 per month will save $320 to $640 a month gross, but deducting the cost of the truck and the wages of the operator from the savings, we have a net saving of $192 to $512, or enough to pay for the equipment in from five to fourteen months. The above savings are over and above such savings as are made in increased storage space, time saved in emergencies, idle time of motor trucks, decreased accidents or damage to material handled.

Power stations as well as stores departments present miscellaneous handling problems of a magnitude far greater than is generally appreciated. The experience at the Hell Gate station of the United Electric Light & Power Company illustrates the point in question. At the time that this station was put in service an electric industrial truck with a dump body skid was installed as stand-by equipment to be called into service in case the regular coal-handling equipment for any one boiler should be temporarily out of service. The investment was made purely to insure continuity of service and it was expected that the truck would stand idle in the boiler room except for very exceptional occasions.

Power companies accustomed to investment in equipment

It had not been installed long, however, before it was borrowed for such work as installing valves and pipe sections or elevating heavy plates. Its elevating platform was found useful in cleaning or replacing gage glasses or as a staging for workmen repacking valves and the like. Soon other departments asked to borrow the truck and it was constantly in use in the machine shop, repair shop, or yard. Here was a piece of equipment that could go anywhere and take care of a wide variety of handling jobs that were expensive, arduous and often dangerous by the old methods. Such jobs as unloading from the tailboard of a motor truck or moving a 10,000-lb. pump impeller are typical of this class of work. Such opportunities for savings grew so fast that before long the original truck, which was thought to be a "dust collector," which is the mechanic's name for stand-by equipment, had more than it could do and a second machine was purchased. Now, although the two machines are available as stand-by equipment, they are busy during the entire day.

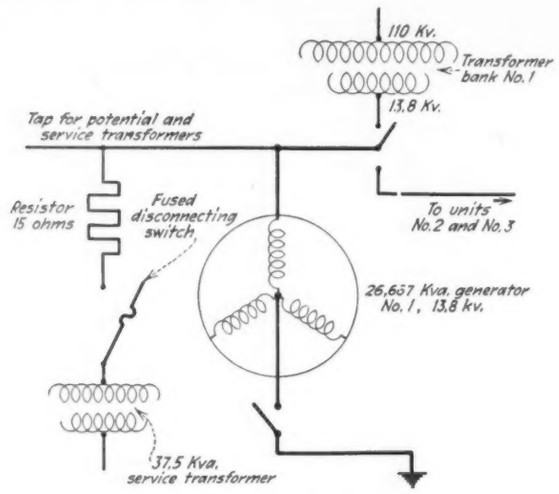
It may be that not all electric power companies are fortunate enough to have large new storerooms, with wide aisles and doors, and therefore believe that it is impossible for them to apply electric power to their own handling problems. The above conditions, however, are not peculiar to the electric power industry. Old buildings and narrow aisles occur throughout industry, and in an effort to make the equipment more and more useful the truck manufacturers have now developed a machine that will go practically anywhere a hand truck will go, but will carry five to ten times the load at two or three times the speed of a man. This machine is less than 30 in. in width, will pass through a standard 2-ft. 9-in. doorway, turn in 48-in. aisles and yet has a rated capacity of 3,500 lb. Such a machine may be used directly in operations which are at present performed by hand.

The economic life of the electric power industry is founded on the basic fact that enormous investments in plant and equipment can be made to yield a net return even if the gross revenue yearly is only one-fourth to one-fifth of such investment. With this background it is difficult to see how the central-station executive can hesitate to invest in materials-handling equipment whose net return will be from 50 per cent to 200 per cent of the necessary expenditure.

Fused Switch-Resistor Units for Station Transformers

By A. E. TREMAINE
Engineering Department,
New England Public Service Company, Augusta, Me.

In the design of the Wyman hydro-electric station of the Central Maine Power Company at Bingham it was necessary to take a small amount of auxiliary power from the main bus, where possible short-circuit currents are large. Each generating unit obtains its auxiliary power


110 Kv.
Transformer bank No. 1
13.8 Kv.
Tap for potential and service transformers
Resistor 15 ohms
Fused disconnecting switch
To units No. 2 and No. 3
26,667 Kva. generator No. 1, 13.8 kv.
37.5 Kva. service transformer

Fuses and resistors are placed between service transformer and generator leads

from a 37.5-kva. transformer connected directly to the generator mains between the generator and the step-up transformers feeding the outgoing 110-kv. lines. As each generator has a rating of 26,667 kva. at 13.8 volts and is connected through a corresponding transformer bank of the same rating to a main 110-kv. bus the transient short-circuit capacity at this point is about 350,000 kva. To install oil circuit breakers alone or in series with reactors would take space and involve considerable expense; hence it was decided to install Schweitzer & Conrad fuses with resistors in series. These resistors are of 2 amp. capacity continuous rating and have a resistance of 15 ohms each, reducing the short-circuit current to about 530 amp. This is well within the rupturing capacity of the fuses. Fused disconnect switches were used, with the resistance mounted on the same insulators, making a compact installation. The initial development includes two generators, a third to be added at a later date.

▼

Air Recirculation Prevents Generator Dampness

By C. W. COLVIN
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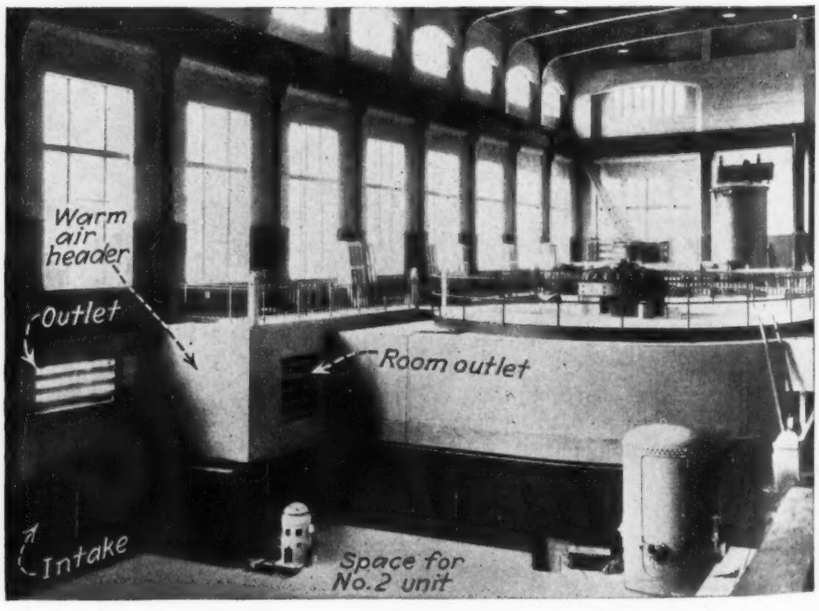
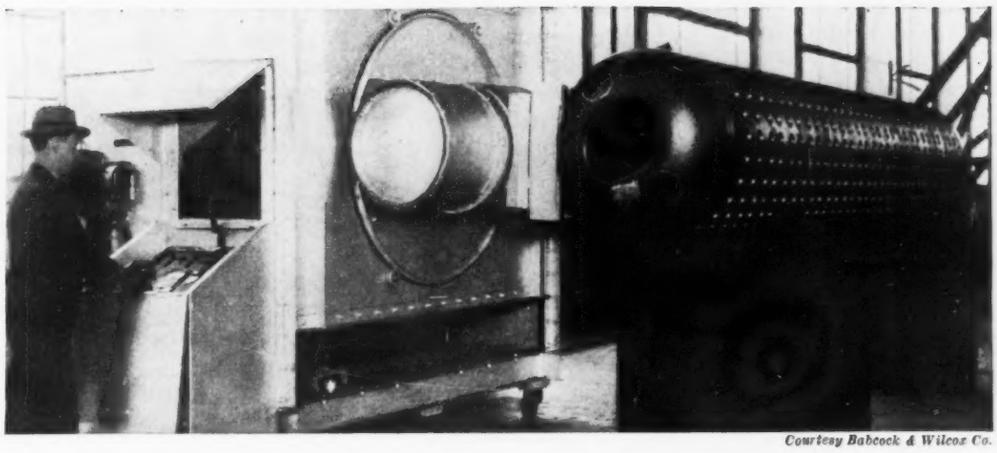
B. C. Electric Railway Company, Vancouver, B. C.

So far as known the arrangement for handling ventilating air at the Ruskin hydro-electric plant of the British Columbia Electric Railway Company, Ltd., has not been used elsewhere in its entirety. Air is taken from outside the building through adjustable hand-operated louvers at the building limits, passed through a dry type air filter and then through self-closing electric trip doors into the turbine pit. It is then drawn up into the generator, passed through the stator windings into an air casing completely surrounding the machine and then through another set of self-closing electric trip doors into what is termed a warm air header. From the header it may be directed at will to the outside of the building, to the inside for heating purposes, or to (in the future) an idle machine. The accompanying illustration serves further to show this arrangement.

It is hoped by passing heated air into an idle machine to obviate condensation therein and to maintain a fairly even temperature with a consequent reduction in expansion and contraction of windings. This should result in reduced maintenance and longer life in a plant such as Ruskin, which was built primarily for carrying peaks. It should be mentioned that the self-closing electric trip doors are for stopping all circulation of air through the generator in the event of fire, in which case CO_2 is automatically released.



Warm air circulated through unit prevents condensation and temperature changes



Courtesy Babcock & Wilcox Co.

Welded boiler drum being subjected to X-ray examination. This is just one test for examining completed welds. Electromagnetic methods have also been devised. Each method has its limitations. Machine welding technique has been developed to produce such uniform welds that no subsequent tests are necessary to determine homogeneity, some manufacturers claim.

Attitude of Eleven Utilities Toward Welded Boilers

CONSIDERABLE experience has been accumulated on the effectiveness, safety, reliability and economy of welded structures. Simultaneously organization and persons interested in the possibilities of welded structures have experimented with different ways of developing careful welders and methods of detecting faulty welds. Welds made by trained welders have been subjected to tensile or microscopic tests to ascertain whether superficial or more penetrating methods of examination can be correlated with weld characteristics. Welding specifications and procedure have been developed.

In shop-welded jobs, such as new boiler drums and tubes would involve, manufacturers have been virtually unanimous in adopting machine welding which removes any variabilities resulting from manual welding and substitutes machine precision. Even some field welding jobs can be performed by machines. Hence, when tests show that a given procedure gives the best results, the welding machine can be set for that procedure, and much more uniform weld characteristics can be obtained than with manual welding. Furthermore, machine welding technique has been developed to the point where it obviates the necessity of many check tests now considered essential with manual welding, but the proposed code will include check tests for machine-made as well as manual welds.

The N.E.L.A. prime movers committee has given welded boiler drums and tubes considerable study and the A.S.M.E. boiler code committee is now engaged in formulating a code that permits such construction. The Navy has on order 46 welded boilers to be installed in new cruisers and airplane carriers.

In view of all these developments, several utility executives and engineering or operating department heads were asked the three questions treated later to ascertain the possible trend of welded boiler acceptance and also what active co-operation might be expected from users in bringing about code acceptance.

Replies were received from the Pacific Gas & Electric Company, Edison Electric Illuminating Company of Boston, the Commonwealth & Southern Corporation, Columbia Engineering & Management Corporation, Byllesby Engineering & Management Corporation, Duke Power Company, Milwaukee Electric Railway & Light Company, Buffalo, Niagara & Eastern Corporation, Philadelphia Electric Company, Detroit Edison Company and the Commonwealth Edison Company. These companies have an aggregate steam generating capacity of 7,572,098 kw., indicating the influence they will have on acceptance and active co-operation.

Owing to the fact that frank, unrestricted comments could not be obtained for publication without concealing the identity of persons and companies and their respective answers, the replies have been mixed to prevent identification.

The replies to three groups of questions follow:

1. Would you agree to adopting power plant boilers with welded drums and tubes if your engineers recommended them?

Although one executive out of eleven utility men definitely and emphatically replied no to this question, and another man excluded welded tubes for reasons mentioned later, the consensus of replies from executives was: "We would not hesitate to use electrically welded drums and tubes when recommended by our engineers provided the basis of their recommendations was sound." One executive went so far as to declare: "The welding of pressure vessels is bound to come as welders become more proficient in their art."

Since a question has arisen frequently, particularly

among manufacturers, regarding the relative authority of utility engineers and their respective executives, these executives have been asked whether they would accept their engineers' recommendations without being personally assured of the safety and service continuity of departures from customary practice.

One department head very pointedly answered this question by saying: "This question is very much like asking a man whether he would jump in the river if he could not swim. He might do it if he were crazy." Other replies might be characterized by one executive's answer: "We would most certainly not recommend such construction without adequate proof of its safety and service continuity and evidence that the welding had been done properly." An open-minded attitude was expressed by another executive who said: "I understand your question to raise an inquiry as to whether I would be opposed to using power plant boilers with welded drums and tubes even if recommended by our mechanical engineers department. The answer is obviously no. I might, of course, disagree with the reasoning of the mechanical engineer, but I haven't normally found myself in a position where I had to do anything of that sort, and I should naturally assume that the burden of proof was on me if I did have to."

Commenting on this general subject of acceptance more in detail, five executives and six department heads replied as follows:

"As far as the welding of boiler drums and tubes is concerned, we regret that there is anything in the code to prevent it and believe every effort should be made to permit welded equipment to be used. Such experience as we have had in patching boiler tubes, water-wall tubes, etc., by the welding process assures us that if the work is done properly it will be safe and satisfactory. Welding, such as done by reputable manufacturers, would, we believe, be satisfactory in steam boilers. Just what safeguards it will be necessary to surround the work with we are not prepared to say, but believe they can be developed. We believe that every reasonable thing should be done to have the boiler codes changed to permit welding."

"Our engineers are ready to recommend welded drums when they will be assured that the welding is dependable, because any forged or welded drum would by its avoidance of riveted butt straps present fewer capillary spaces for the possible concentration of caustic soda and be to that extent more nearly immune to caustic embrittlement. The fact that such a drum can actually be heat-treated after fabrication likewise makes it possible to be rid of unnecessary internal stresses often present in riveted drums. In other words, drums without rivets can be much superior to the older type of construction. We are not so sure about welded tubes, since the process of making seamless tubes is comparatively cheap."

"The question of welded drums and tubes is of great interest, especially since we are all endeavoring to reduce the investment cost of our plants. I believe the art of welding has progressed to a point that makes it desirable to try out."

"I understand the Navy has arranged to use some boilers with welded drums, and, personally, I see no reason why it should not be safe. The only way to find out is to try out some of the welded work and have frequent examinations made to determine its condition."

"Both Mr. ——— and myself have for some time been urging various manufacturers to take the necessary steps to obtain a revision of the A.S.M.E. Boiler Code to permit electric welding of drums. I am prepared to recommend their purchase as soon as the code permits their use. As you know, we have bought a considerable number of hammer-welded drums in the past, as we believe that riveted joints are undesirable in boiler drums."

"We think that the particular urge for the adoption of welded construction in boiler drums will come from the saving and costs of installations operated at 1,200 lb. and above and from companies operating in localities where caustic embrittlement represents a real problem."

"As the difference in cost between welded and riveted boiler drums is trifling compared with the cost of the whole power plant, the whole boiler room with equipment, or even the cost of the boiler itself, a conservative purchaser would want to know that his engineers had carefully balanced savings against possible difficulties before making such an experiment, and thereafter would cautiously adopt such an innovation, as he does other changes in power house equipment. But you could scarcely expect such a purchaser or his engineers to go beyond the recommendations of the boiler code committee."

"Years ago a great amount of trouble was experienced with welded tubes and practically all companies discontinued their use. Many serious tube ruptures occurred. The faults of the old manufacturing process may have been eliminated but new ones probably have been substituted. I am not sold on this suggestion."

"Nothing has been said about welded tubes because we have had no experience with them, and for the moment I do not see anything to be gained by the substitution of electrically welded tubing for the seamless drawn type that has been so satisfactory for years."

"Tests of welded construction throughout the past several years, together with recent tests of so-called fusion welded drums, have demonstrated the safety of such structures and a large number of tests with reference to fatigue and shock have proved satisfactory."

2. "What kind of evidence would you demand to assure yourself of the reliability of welded boiler drums and tubes?"

Uncertainty as to just what tests would be necessary to assure reliability and safety of such construction was indicated by some executive replies, but one department head expressed a viewpoint quite characteristic of other engineers. He said: "The tests suggested by the A.S.M.E. code committee are, in my estimation, satisfactory and should not be reduced. I believe that, in the present state of the art, examination by X-ray is essential."

It should be pointed out that X-ray is only one method which may be used for examining welds. Like electromagnetic and other tests it has certain limitations. Furthermore technical ingenuity may be expected to develop other tests which may be equally as good or even more effective. Machine welding technique has been developed, so that subsequent tests of welds are not essential, according to some manufacturers.

Generally speaking, the executive replies were that the tests should be of such kind and character as would remove any question of doubt as to reliability and safety.

Complete elimination of the human factor in making the weld was recommended, but it was added that the only safe test is that of time. Even then the condition of operation might be favorable and therefore not conclusive. Tests should cover operating conditions, such as varying temperatures, stresses and water conditions.

One executive, who was previously quoted as saying, "Our engineers are ready to recommend welded drums when they will be assured that the welding is dependable . . . ," added: "Of course, we would not adopt welded drums without extraordinary assurance of safety of the welding. We would call for an examination of the samples of the manufacturer's welding, would avail ourselves of the manufacturer's offer to X-ray the welds for their entire length, and of course would await approval by the A.S.M.E. code."

Performance in service and examination by X-ray or some other satisfactory methods were emphasized as desirable tests by other persons.

Another executive says: "I would deem adequate tests and metallurgic analyses, particularly with reference to the stability of the welds and their resistance to any corrosive action or metallurgic deterioration, *prima facie* evidence of the satisfactory character of welded drums or tubes, but would want to see such evidence supplemented by actual high-pressure, high-temperature experience on a small scale, preferably in one of our own plants, before committing myself categorically to welded construction."

3. If you were convinced of the economy and reliability of welded boiler construction would your company's engineers actively help to bring about code acceptance? Do your committee affiliations give you an opportunity to express your personal opinions before an organization which has a voice in formulating national boiler codes?

Since some questions have been raised regarding the intent of these questions, it should be pointed out that the purpose was to ascertain whether utilities would remain passive bystanders or active co-operators with organized authorities faced with provision for welding in the boiler code. In other words would they allow the code to take its course and raise objections after formulation or would they voluntarily bring before the code committee for guidance their requirements as buyers? Judging from the answers, the purpose of the questions was understood by the operating executives and department heads who replied, as there is no indication of any intent to influence the code except in an open, aboveboard co-operative spirit.

The following reply is quite characteristic of all replies: "We are affiliated with the prime movers committee of the N.E.L.A., which has given the subject some study. The A.S.M.E., of which some of our engineers are members, is also actively engaged on the subject, and it is our hope that there will be definite results before long. We would be very glad to have our engineers do whatever they can to bring about code acceptance under the conditions embodied in your question,"

One person adds: "It is my opinion that we should take such steps as may be possible to hasten the acceptance of welded drums by the A.S.M.E. code committee."

One executive says: "We would actively help to bring about code acceptance if we had any very pressing need for this type of construction."

However, another executive replied that his company's co-operation in bringing about code acceptance would "depend entirely upon whether the economies were to go to the manufacturer or the purchaser."

The reply to the latter half of question (3) might be characterized by the following answer:

"Personal opinions on such engineering subjects are cleared through the American Society of Mechanical Engineers and the prime movers committee of the National Electric Light Association. We are of the opinion that the position of the prime movers committee will have a considerable bearing upon the adoption of welded drums for large sizes and high pressures, since this committee represents a large portion of the users of such equipment. The prime movers committee is actively represented on the A.S.M.E. boiler code committee."

The possibility of active user co-operation in bringing about changes in practice is expressed by one executive who said: "Conviction as to the economy or reliability of such construction, or any construction which would widen procurement possibilities, would assuredly lead our engineers actively to help bring about acceptance."

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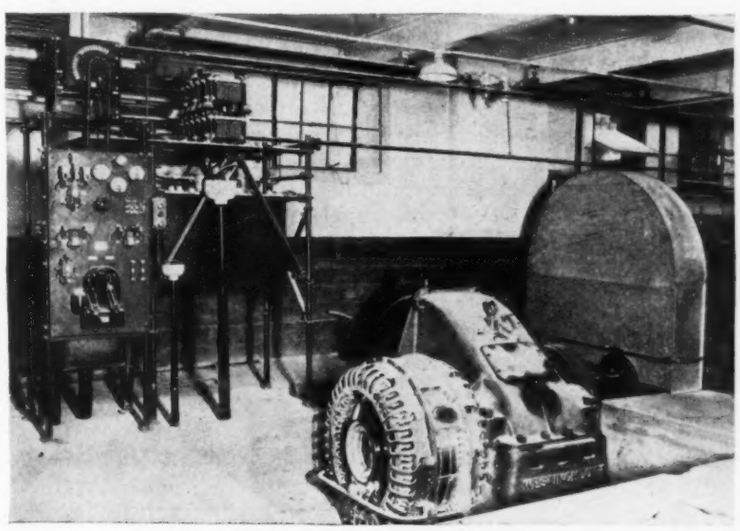
Overhung Motor-Gear Reduces Space Requirements

A highly efficient and economical rubber mill drive of unusual design has recently been installed by the Gillette Rubber Company, Eau Claire, Wis. Here three pairs of mixing rolls are driven by means of a 250-hp., 720-r.p.m. synchronous motor in combination with a gear reduction unit transmitting power to a lineshaft at 90 r.p.m. In this drive the usual motor bearings and flexible coupling have been eliminated by overhanging the rotor of the motor directly on the extended pinion shaft of the gear unit. This simplified assembly results in a considerable saving of floor space as compared with a coupled drive. The gear unit is of the single helical type. Such a combination geared motor drive is not only applicable in rubber mills but can also be efficiently applied in many other industries.



How Motors Perform on 208-Volt N

By E. F. KURTZ

Industrial Engineering Department,
General Electric Company, Schenectady, N. Y.

THE 208-volt a.c. secondary network which is so rapidly growing in popularity for electrical distribution in the larger cities provides a slightly off-standard motor voltage and thus has provoked a large number of questions in regard to the use of motors and control designed for 220 volts. Standard 220-volt motors and control can be successfully used on these systems, as will be evident from a consideration of their operating characteristics and applicability at the lower voltage.

For the sake of economy and efficiency of distribution, it has been found best to use one set of mains for both the single-phase lighting load and three-phase motor load, taking advantage of the diversity of these loads to economize in copper.

The majority of the power companies adopting networks have tried to meet these requirements by choosing a three-phase, four-wire system, using Y-connected transformer secondaries with grounded neutral. A potential of 120 volts for lighting was selected as the highest permissible standard which would not make obsolete many of the household appliances already in use. This obviously gives a three-phase motor voltage of $\sqrt{3} \times 120 = 208$, which is $5\frac{1}{2}$ per cent below the standard of 220 volts. In a very few instances a single-phase or lighting voltage of 115 has been used, resulting in a three-phase voltage of 199.

The resulting operation, when standard 220-volt induction motors are used on 208 volts, is not markedly different from normal, since the slight change which occurs in each of the starting and running characteristics is usually too small to be noticeable.

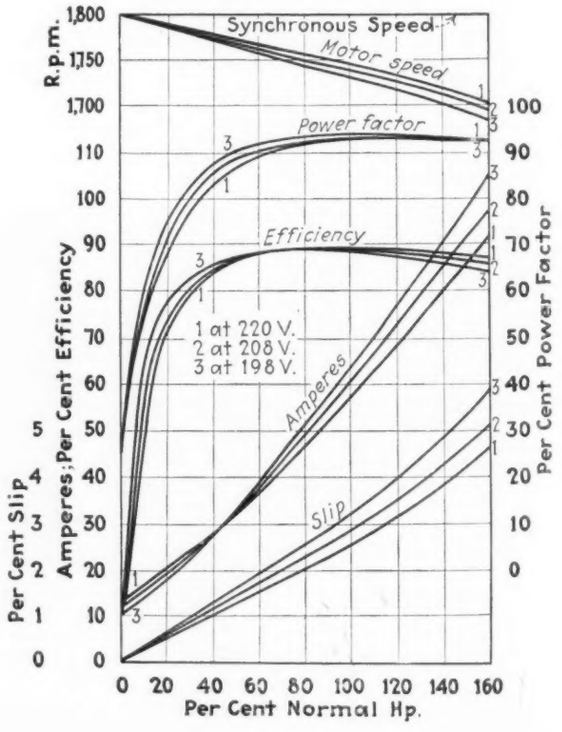
The starting torque and maximum running torque of induction motors vary approximately as the squares of the applied voltages, hence a 220-volt motor will have these characteristics reduced 11 per cent when operating on 208 volts. The same holds true of the maximum momentary overload capacity in horsepower.

The reduction of these values does not affect the ordinary motor application because torque and maximum output are not usually limiting features. On applications of a special nature, such as elevators, where high-torque motors are required, the application can be checked from this standpoint and a motor having the necessary torque applied. In some of these cases oversized motors may be applied and in others a special motor designed for 208 volts can be used. In some cases it may be found desirable to boost the voltage at the motor terminals with an auto-transformer.

The efficiency of an induction motor is affected by a 5 per cent reduction in voltage to a very slight degree. The losses of the average motor totaling 11 per cent at rated voltage and load are segregated as follows:

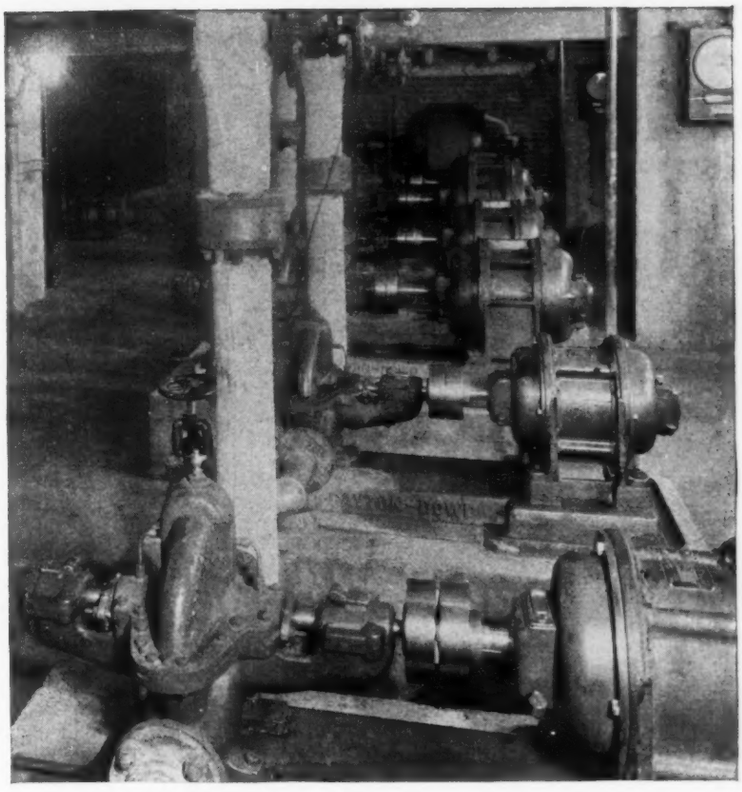
	Per Cent
Primary copper loss	3.6
Secondary copper loss	3.2
Core loss	2.6
Friction and windage loss	1.6
Total	11.0

The primary copper loss varies as the square of the primary current. The primary current with such a small



Operation at reduced voltage has moderate effect on induction motor performance

Network supplies motors driving battery of pumps in commercial building



Networks

Standard 220-volt induction motors operated at 208 volts lose only about 11 per cent in torque and 1 per cent in efficiency without unsafe temperature rise

change in voltage varies inversely as the voltage (approximately). So the primary copper loss varies inversely as the square of the voltage. The same holds for secondary copper loss. The core loss varies between the 1.6 power and the square of the voltage. The friction and windage are a constant. Then with a reduction in voltage from 220 to 208, or 5.5 per cent, the losses will change to the following:

	Per Cent
Primary copper loss	4.0
Secondary copper loss	3.6
Core loss	2.3
Friction and windage loss	1.6
Total	11.5

The efficiency has dropped very slightly, from 89 per cent to 88.5 per cent. Such a small change in efficiency is of little consequence and only slightly affects the temperature rise of the motor.

At half load the efficiency is generally higher at 208 than at 220 volts, although the copper losses are increased with the reduction in voltage, the core loss is reduced. Since the copper losses are comparatively small at half load their increase is overbalanced by the lower core loss at the lower voltage.

The effect on power factor is hard to analyze in a quantitative way, but a reduction of voltage from normal at rated load reduces the "90 deg. current" or excitation current, while it increases the in-phase or load current, improving the power factor. A reduction of voltage on the average induction motor from 220 to 208 improves the power factor by about 1/100 at full load and 2/100 at half load.

The starting current or blocked rotor current is reduced in direct proportion to the reduction in voltage. In other words, the starting current at 208 volts is approximately 94.5 per cent of that at 220 volts.

$$I = \frac{E}{Z}$$

The equivalent inpedance Z_0 is a fixed value except for a variation caused by saturation, often encountered at or near full voltage. The saturation reduces Z_0 by reducing its component part, X_0, and so increases the full-voltage starting current. At 208 volts the effect of saturation would be less, so the starting current may in some cases be less than 94.5 per cent of its 220-volt value.

The full-load current of a motor operated at a reduced voltage is higher than normal since the line current for a three-phase motor =

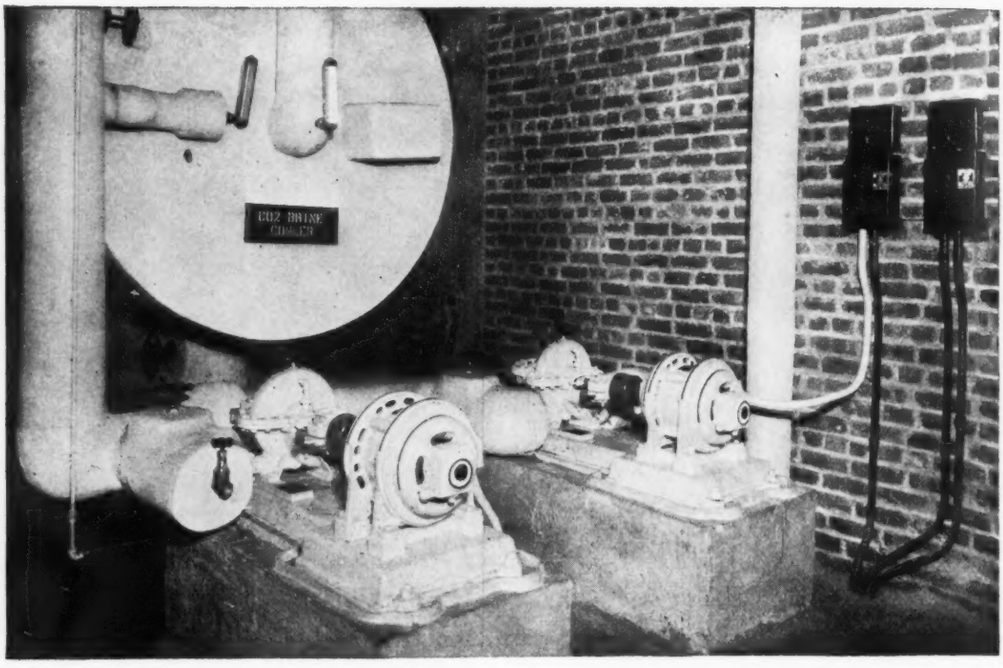
$$\frac{\text{hp.} \times 746}{\sqrt{3} \times \text{line voltage} \times \text{Eff.} \times \text{p.f.}}$$

Taking into account the changes in motor efficiency and power factor for the same horsepower, the average motor operated at 208 volts has a current equal to 105 per cent of its 220-volt value.

The slip of an induction motor varies approximately inversely as the square of the voltage. The slip of a 220-volt motor is increased to about 1.12 times its normal value when operating on 208 volts, but as the slip is normally but a few per cent of synchronous speed, the full-load speed is not materially changed.

As an example, assume a six-pole, 60-cycle motor with full-load speed of 1,140 r.p.m. at 220 volts. The slip is 1,200 — 1,140 = 60 r.p.m. At 208 volts the slip becomes 1.12 × 60 = 67 r.p.m. and the full-load speed 1,200 — 67 = 1,133 r.p.m.

The temperature rise of a motor varies with the watts-loss to be dissipated and the speed at which the motor runs. As shown above, changing the line voltage over a small range does not materially change the speed so as to affect the rate of dissipation of heat. But in the discussion of efficiency, it was shown that the losses



Brine and air conditioning equipment driven by induction motors off network

might be expected to increase from 11 per cent to 11.5 per cent. The ratio of the temperature rise at 208 and 220 volts will then be that of 11.5 to 11, or an increase of about 4.5 per cent at the lower voltage.

The performance of low-speed motors is not quite as good as the average motor used in the above example and the differences with changes in voltage are greater. However, the increase in heating is in most cases less than 5 per cent and it should never be more than 10 per cent. The term heating is here used for the temperature rise above the ambient temperature. This means that if a motor were running with 40 deg. C. rise at 220 volts, with the same load at 208 volts the rise would not go above 44 deg. C., and probably not above 42 deg. C. Since most standard motors test less than 40 deg. C. rise at full load with normal voltage and frequency, they would not heat above 40 deg. rise with 208 volts.

Class A insulation, which is used on general-purpose induction motors, may be used up to 50 deg. C. rise on open motors in 40-deg. C. ambient air without injurious effects from heating. The motors operating on 208 volts will not reach this temperature rise without an overload and they will in few cases be operating in ambient air as high as 40 deg. C. (104 deg. F.), so they actually have an additional margin of safe operation.

A 220-volt motor operated on 208 volts will have a slightly higher temperature rise than normal, but not sufficiently higher to be of any consequence.

It is interesting to note that the standard general-purpose, constant-speed motor, rated 220 volts, is designed by most manufacturers to operate successfully at normal frequency and voltage where the variation in voltage does not exceed 10 per cent above or below normal, but not necessarily in accordance with the standards established for normal voltage and frequency.

The standard guarantee requires successful operation for 220-volt motors within the upper and lower limits of 242 and 198 volts. The voltage of 208-volt combined light-and-power networks stays within these limits, since they are held to a plus or minus voltage regulation of 3 or 4 per cent, as stated above (4 per cent above and below 208 is 217 and 199).

The guarantee in regard to successful operation with 10 per cent voltage variation is based on the voltage stamped on the nameplate. If a 208-volt nameplate is put on a 220-volt motor, it implies that the motor will again operate successfully at 10 per cent below the nameplate voltage. The motor manufacturer then undertakes added responsibility for successful operation over the lower voltage range and, since a special stator winding is often required, is obliged to increase the price correspondingly.

Although the number of companies operating networks has increased to approximately 50, the majority of which are 208-volt networks, with quite a few more under consideration, the motor load which will be connected to these networks will obviously never approach a major, or even a large, percentage of the total motor load of this country. Consequently it does not warrant a change in the standard motor voltages already established

When starting squirrel-cage induction motors on a combined light-and-power network system the starting current must be held to a value which will avoid a dip in voltage sufficient to produce a noticeable or objectionable change in illumination. Results of tests* "indicate that 2 per cent instantaneous variation in voltage cannot be detected, but that 3 per cent is the maximum possible for the highest grade service. Changes of 5 per cent, however, will not be observed in most conditions found in practice."

The permissible starting current which will not cause a dip exceeding the above limits depends upon the size of transformers and secondary cables, upon transformer reactance and the location of the motor relative to the transformers.

*"*Underground Alternating-Current Network*," by A. H. Kehoe, "A.I.E.E. Journal," June, 1924.

The other network loads adjacent to a motor of any size are in general of considerable magnitude, requiring transformers and secondary cables of large capacity, so that many network systems can take care of virtually any squirrel-cage motor application using a standard compensator, or even a full voltage starter. In some cases motors are too large for their particular section of the network to start with one reduced voltage step, and more elaborate starters are specified by the power company which will insure the starting current being brought up in increments at ½-second intervals.

While there will be a very few exceptions to the foregoing outline of operation of 220-volt apparatus on 208-volt networks, they will be relatively rare and will not make it necessary for the users of network power to burden themselves, except in these rare cases, with special 208-volt motors and control equipment. On the contrary, the less expensive, more readily obtainable and standard 220-volt equipment will generally prove entirely satisfactory.

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Some Elements of the Fly-Ash Problem

By H. H. Bubar

President Dust Recovery, Inc., New York, N. Y.

The solution of the fly-ash problem lies in reducing the amount of ash that is discharged to the atmosphere to the point where it is no longer objectionable. When objections cease, nuisance ends, and it would be useless extravagance to go further with fly-ash collection than is required by the nuisance values of each case.

Under modern operating conditions of pulverized fuel firing it may be safely stated that an average of 70 per cent of the total ash in the coal goes up the stack. This dust is extremely fine, averaging more than 85 per cent through a 300-mesh screen in those installations with which the author is familiar. The fly-ash problem rests squarely on this 70 per cent that escapes from the stack.

It has been found, as an average result, that approximately 1.5 per cent of the fly-ash will be retained on a 100-mesh screen, 4.5 per cent on a 200-mesh screen, 9 per cent on a 300-mesh screen and the remaining 85 per cent would pass through a 300-mesh screen. The dust passing through the 300-mesh screen has been studied microscopically and the diameter computed in microns, which is 1/1,000 of a millimeter, or about 1/25,000 of an inch. This fineness is expressed in terms of screen mesh, assuming such screens exist with the size of the opening and diameter of the wire the same.

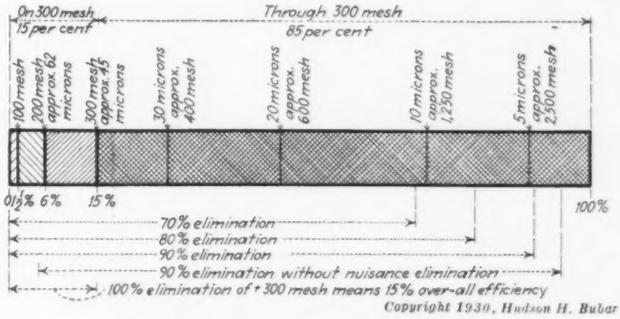
On the chart it will be observed that slightly more than 50 per cent of the total dust is less than 20 microns in diameter and approximately 27 per cent is less than 10 microns in diameter. A dust particle 25 microns in diameter, when elevated to a height of 200 ft. will travel 16 miles in a 10-m.p.h. breeze before falling to the ground and a fly-ash particle 12 microns in diameter will travel 65 miles under the same conditions.

With the assumption that a fly-ash particle 12 microns in diameter will, when initially elevated to a height of 200 ft., travel a distance of 65 miles in a 10-mile breeze before settlement, it can logically be assumed that those particles less than 12 microns in diameter cannot be considered as constituting a dust nuisance, as in traveling that distance, or even half that distance, they would become so diffused as to be impossible of detection. Under actual operating conditions these finer particles will travel more than double the distance stated, as when leaving the stack they are carried up in a high-temperature gas which has a decided tendency to buoy the dust particle up to double, and even treble, the elevation of the stack.

Close observation of any stack emitting fly-ash and on which there is no dust-collecting apparatus reveals the fact that rapid expansion of the dust cloud occurs. Below the elevation of the stack it will be noted that a certain portion of the dust settles rapidly toward the ground. Another portion carries on a comparatively horizontal line, while the great majority continues to rise until it has passed the limits of vision. On stacks equipped with dust collectors which remove all of the coarser dust particles and a greater percentage of the fine it will be observed that all of the dust cloud continues to rise until it has passed the limits of vision.

It may be definitely concluded that proper dust elimination demands the recovery of all of the plus 300-mesh material and the bulk of the minus 300-mesh material, and that when this is obtained a recovery of 70 or 80 per cent of the total dust will thoroughly eliminate the nuisance.

One of the great American cities is now considering an amendment to its sanitary code. It tentatively proposes to establish a standard whereby the gas going to the atmosphere from stoker-fired or pulverized-coal installations shall not contain more than 0.2 of a grain of solids per cubic foot of gas. This result can readily be obtained when dealing with cinders, but with fly-ash it cannot be secured without a prohibitive expense for equipment. Furthermore, no mention is made of the screen analysis of the escaping dust. Obviously, if the permitted dust loading of the escaping gas of 0.2 grains is coarse material, the nuisance is not abated. On the other hand, the dust loading of 0.2 grains, if composed only of 10-micron material, would be excessively low. If all the coarse dust and the bulk of the fine in fly-ash were trapped, it would still be possible to exceed 0.2 grains per cubic foot of gas and not commit a nuisance. Lack of accurate data is alone responsible for such a



Typical screen analysis of fly-ash

This graph shows that 85 per cent of the ash carried in stack gases from powdered-coal-fired boilers will pass through a 300-mesh screen.

*Presented at the recent National Fuels Meeting of the American Society of Mechanical Engineers in Chicago, Ill.

situation, and in this case the author has recommended that the code be changed to read that not more than 0.4 grain of fly-ash per cubic foot of gas be permitted to escape and that total elimination of the plus 300-mesh material be required.

Before the problem can be solved it is essential that all parties concerned have a mutual understanding of just what constitutes a nuisance. The initiative in this technical task should be immediately assumed by the engineering profession.

▼ ▼ ▼

Recommended Levels of Illumination for Industrial Interiors

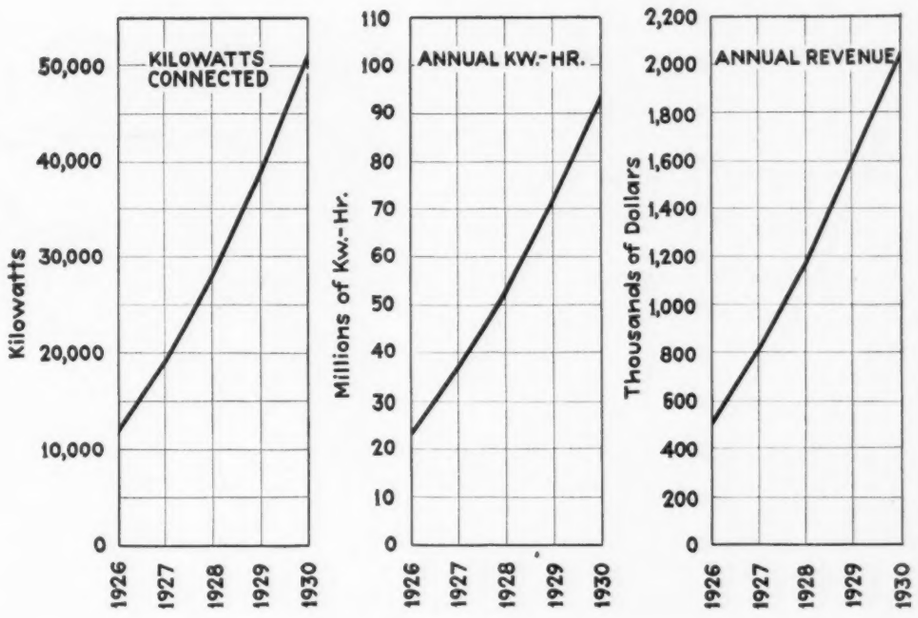
American Standards Association, 1930

	Foot-Candles Recommended
Aisles, stairways, passageways	3– 2
Assembling	
Rough	8– 5
Medium	12– 8
Fine	20–12
Extra fine	100–25
Automobile Manufacturing	
Automatic screw machines	15–10
Assembly line	15–10
Frame assembly	12– 8
Tool making	20–12
Body manufacturing—assembly, finishing and inspecting	100–25
Bakeries	12– 8
Book Binding	
Folding, assembling, pasting, etc	8– 5
Cutting, punching and stitching	12– 8
Embossing	15–10
Candy making	12– 8
Canning and preserving	12– 8
Chemical Works	
Hand furnaces, boiling tanks, stationary driers, stationary or gravity crystallizing	5– 3
Mechanical furnaces, generators and stills, mechanical driers, evaporators, filtration, mechanical crystallizing, bleaching	6– 4
Tanks for cooking, extractors, percolators, nitrators, electrolytic cells	10– 6
Clay Products and Cements	
Grinding, filter presses, kiln rooms	5– 3
Molding, pressing, cleaning and trimming	8– 5
Enameling	10– 6
Color and glazing	15–10
Cloth Products	
Cutting, inspecting, sewing—	
Light goods	15–10
Dark goods	100–25
Pressing, cloth treating (oil cloth, etc.)—	
Light goods	12– 8
Dark goods	20–12
Coal breaking and washing, screening	5– 3
Construction	
Indoor general	5– 3
Dairy products	12– 8
Electric Manufacturing	
Storage battery, molding of grids, charging room	10– 6
Coil and armature winding, mica working, insulating processes	20–12
Elevator—Freight and passenger	8– 5
Engraving	100–25
Forge shops and welding	10– 6
Foundries	
Charging floor, tumbling, cleaning, pouring and shaking out	8– 5
Rough molding and core making	10– 6
Fine molding and core making	15–10
Garage—Automobiles	
Storage—Dead	3– 2
Live	8– 5
Repair dept. and washing	15–10
Glass Works	
Mix and furnace rooms, pressing and Lehr, glass blowing machines	10– 6
Grinding, cutting glass to size, silvering	12– 8
Fine grinding, polishing, beveling, inspection, etching and decorating	15–10
Glass cutting (cut glass), inspecting fine	50–15
Glove Manufacturing	
Light goods—	
Cutting, pressing, knitting	12– 8
Sorting, stitching, trimming and inspecting	15–10
Dark goods—	
Cutting, pressing, knitting, sorting, stitching, trimming and inspecting	100–25
Hat Manufacturing	
Dyeing, stiffening, braiding, cleaning and refining—	
Light	10– 6
Dark	15–10
Forming, sizing, pouncing, flanging, finishing, ironing—	
Light	12– 8
Dark	15–10
Sewing—	
Light	15–10
Dark	100–25

	Foot-Candles Recommended
Ice Making	
Engine and compressor room	10– 6
Inspecting	
Rough	10– 6
Medium	15–10
Fine	25–15
Extra fine	100–25
Polished surfaces	Usually requires glint reflections from specially located light source
Jewelry and watch manufacturing	100–25
Laundries and dry cleaning	12– 8
Leather Manufacturing	
Vats	5– 3
Cleaning, tanning and stretching	6– 4
Cutting, fleshing and stuffing	10– 6
Finishing and scarfing	15–10
Leather Working	
Pressing, winding and glazing—	
Light	12– 8
Dark	15–10
Grading, matching, cutting, scarfing, sewing—	
Light	15–10
Dark	100–25
Locker rooms	6– 4
Machine Shops	
Rough bench and machine work	10– 6
Medium bench and machine work, ordinary automatic machines, rough grinding, medium buffing and polishing	15–10
Fine bench and machine work, fine automatic machines, medium grinding, fine buffing and polishing	20–12
Extra fine bench and machine work, grinding (fine work)	100–25
Meat Packing	
Slaughtering	8– 5
Cleaning, cutting, cooking, grinding, canning, packing	12– 8
Milling—Grain Foods	
Cleaning, grinding and rolling	8– 5
Baking or roasting	12– 8
Flour grading	25–15
Offices	
Private and general—	
Close work	15–10
No close work	10– 8
Distribution of mail in post-offices	15–10
Drafting room	25–15
Packing	
Crating	6– 4
Boxing	10– 6
Paint manufacturing	10– 6
Paint Shops	
Dipping, spraying, firing	8– 5
Rubbing, ordinary hand painting and finishing	12– 8
Fine hand painting and finishing	15–10
Extra fine hand painting and finishing (automobile bodies, piano cases, etc.)	100–25
Paper Box Manufacturing	
Light	10– 6
Dark	12– 8
Storage of stock	5– 3
Paper Manufacturing	
Beaters, machine, grinding	6– 4
Calendaring	10– 6
Finishing, cutting and trimming	12– 8
Plating	8– 5
Polishing and burnishing	12– 8
Power Plants, Engine Rooms, Boilers	
Boilers, coal and ash handling, storage battery rooms	5– 3
Auxiliary equipment, oil switches and transformers	8– 5
Switchboard, engines, generators, blowers, compressors	10– 6
Printing Industries	
Matrixing and casting, miscellaneous machines, presses	12– 8
Proofreading, lithographing, electrotyping	15–10
Linotype, monotype, typesetting, imposing stone, engraving	100–25
Receiving and shipping	6– 4

	Foot-Candles Recommended
Rubber Manufacturing	
Calendars, compounding mills, fabric preparation, stock cutting, tubing machines, solid tire operations, mechanical goods, building, vulcanizing	12– 8
Bead building, pneumatic tire building and finishing, inner tube operation, mechanical goods trimming, treading	15–10
Sheet Metal Works	
Miscellaneous machines, ordinary bench work	12– 8
Punches, presses, shears, stamps, welders, spinning, fine bench work	15–10
Tin plate inspection	*25–15
Shoe Manufacturing	
Hand turning, miscellaneous bench and machine work	12– 8
Inspecting and sorting raw material, cutting, lasting and welting (light)	15–10
Inspecting and sorting raw material, cutting, stitching (dark)	100–25
Soap Manufacturing	
Kettle houses, cutting, soap chip and powder	8– 5
Stamping, wrapping and packing, filling and packing soap powder	10– 6
Steel and Iron Mills, Bar, Sheet and Wire Products	
Soaking pits and reheating furnaces	3– 2
Charging and casting floors	6– 4
Muck and heavy rolling, shearing (rough by gauge) pickling and cleaning	8– 5
Plate inspection, chipping	25–15
Automatic machines, red, light and cold rolling, wire drawing, shearing (fine by line)	12– 8
Stone Crushing and Screening	
Belt conveyor tubes, main line shafting, spaces, chute rooms, inside of bins	3– 2
Primary breaker room, auxiliary breakers under bins	5– 3
Screen rooms	8– 5
Store and Stock Rooms	
Rough bulky material	3– 2
Medium or fine material requiring care	8– 5
Structural steel fabrication	10– 6
Sugar grading	25–15
Testing	
Rough	8– 5
Fine	15–10
Extra fine instruments, scales, etc	100–25
Textile Mills	
(Cotton)—	
Opening and lapping, carding, drawing-frame, roving, dyeing	8– 5
Spooling, spinning, drawing-in warping, weaving, quilling, inspecting, knitting, slashing (over beam end)	12– 8
(Silk)—	
Winding, throwing, dyeing	12– 8
Quilling, warping, weaving and finishing—	
Light goods	15–10
Dark goods	20–15
(Woolen)—	
Carding, picking, washing and combing	6– 4
Twisting and dyeing	10– 6
Drawing-in, warping—	
Light goods	10– 6
Dark goods	15–10
Weaving—	
Light goods	12– 8
Dark goods	20–12
Knitting machines	15–10
Tobacco Products	
Drying, stripping, general	3– 2
Grading and sorting	25–15
Toilet and wash rooms	6– 4
Upholstering	
Automobile, coach and furniture	15–10
Warehouse	3– 2
Woodworking	
Rough sawing and bench work	8– 5
Sizing, planing, rough sanding, medium machine and bench work, gluing, veneering, cooperage	12– 8
Fine bench and machine working, fine sanding and finish	15–10

How commercial cooking and baking increased on fifteen systems



$42 per Kw. per Year for Commercial Cooking and Baking

By B. M. RIKER

Chairman Commercial Cooking Committee, N.E.L.A.

24 companies in 1930 add . . 32,000,000 kw.-hr. $700,000 revenue

A SURVEY of 24 representative companies shows that during 1930 they added 32,000,000 kw.-hr. from commercial cooking and baking equipment. This consumption represents more than $700,000 in annual revenue permanently added to gross income that will grow of its own accord through satisfied customers who are operating more efficiently and increasing their business by merchandising electrically prepared foods. Several of these companies have started to promote this business within the past two years.

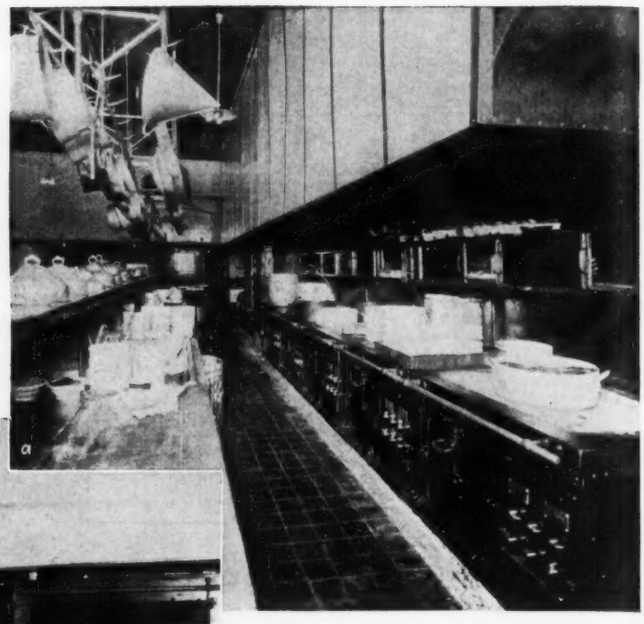
Five years ago there were few companies actively developing electric commercial cooking. Fifteen of these, employing a total of seventeen sales engineers, had developed an average of less than 1,000 kw. of connected load each, with a resulting annual revenue of about $38,000 each. At the end of 1930 these same companies, using a total of 30 men, had a total of more than 50,000 kw. of commercial cooking and baking load on their lines, using an average of more than 1,800 kw.-hr. per year per kilowatt and returning $41.50 gross revenue per year per kilowatt—an increase of more than 400 per cent in five years.

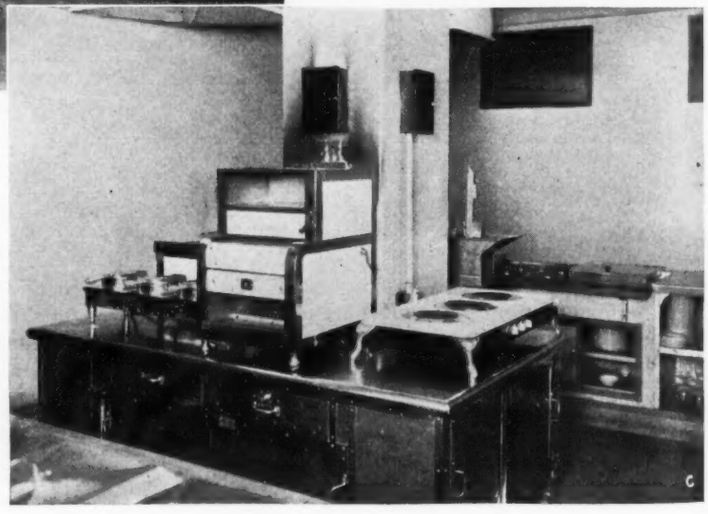
The number of companies employing sales engineers for the specific purpose of developing their commercial market will show an unprecedented increase during the coming year. This is largely due to more comprehensive analyses of sales promotion activities and the increasing demand of the food service industry for information on electric heat—its cost and advantages.

In the larger cities electric cooking and baking is well founded. The automobile and the "kitchenette" type apartment have been important factors in the increasing trend toward "eating out." Restaurants and hotels report a consistent increase in gross income each year in spite of the increase in number of both. The necessity of producing quality food at low cost has promoted consideration of electric equipment. Reduction of overhead and labor charges are essential factors in the commercial kitchen. Retail and wholesale bakeries using modern automatic electric equipment throughout are merchandising their electrically baked products on the basis of quality and cleanliness.

In smaller communities the demand for electric heat in food service trades is growing. In a town of 10,000 population we normally find a potential market of one hospital, sixteen restaurants and cafeterias, two bakeries, one hotel and two institutions and a wide market for counter equipment, which may be installed without

Some typical commercial cooking and baking installations





(a) Chicago Athletic Association: this complete electric kitchen played an important part in the over-all economies for eight years; (b) Forum Cafeteria bake shop, Minneapolis; this adjoins an all-electric kitchen in which two features have been emphasized by the company in building its business of electrically prepared foods; (c) Duke University, Durham, N. C.

affecting existing distribution facilities or customer's wiring, limited only by the number of tea rooms, dining cars, wayside stands, etc.

Classifying this potential market in terms of kilowatts we find an average load per community of 10,000 population as follows:

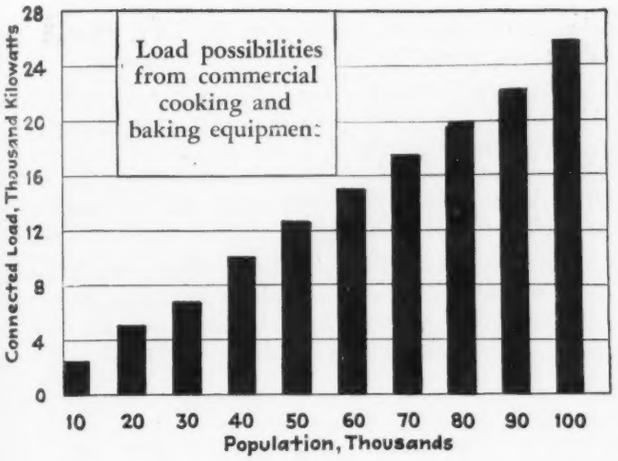
	Kw.		Kw.
Hotels	125	Wholesale bakeries	80
Restaurants	125	Institutions	50
Hospitals	100	Schools and colleges.	100
Retail bakeries	40		

True, surveys of average potential markets do not indicate the limits of specific local markets, but the work of one sales engineer (shown on page 965) in developing this load against active fuel competition illustrates aggressive sales action and results that may be expected.

Competition in this field must grow increasingly keener, since in many cases the electric kitchen or bake shop crosses swords with gas. (Other fuels are being rapidly replaced.) A competitive fuel that has rested comfortably on its laurels for many years is not to be easily overthrown. There must be facts made available that will point the way to economy, efficiency and increased quality production in the kitchen and bake shop.

Lack of knowledge of over-all kitchen or bake shop production costs often subordinates economic discussion to a mere consideration of base-energy rates and the customer's interests may be unintentionally sacrificed. There is a real need for comprehensive analyses of over-all costs on a large scale in order that power companies may sell electric equipment on its merit as an efficient and economic influence in the workshop of the food service industry. The few scattered but thorough studies that have been made prove conclusively that the cost of heating is but one of many factors that make up the cost of food preparation and are influenced by the choice of cooking and baking equipment.

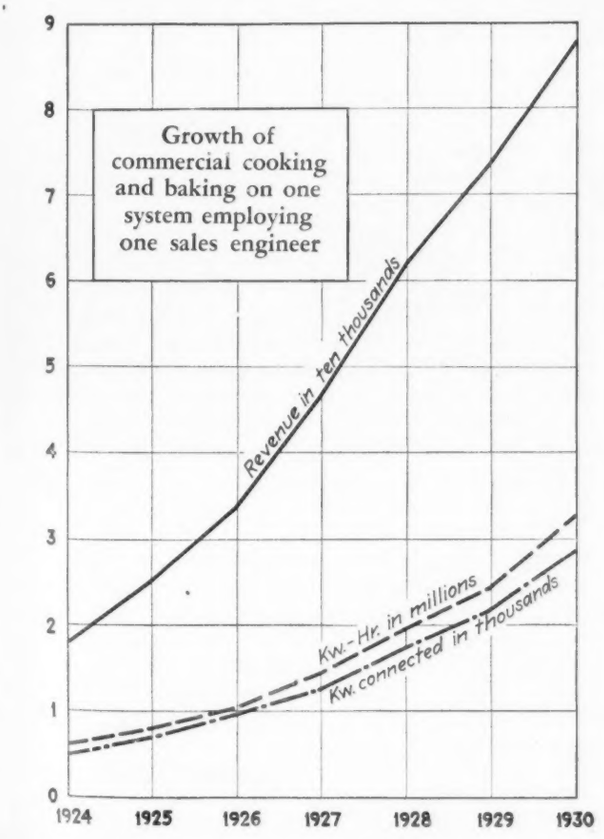
Until recently extensive application of electric heat in the commercial field has been retarded for two prime reasons: First, power companies knew little of the



extent of local markets for commercial equipment and what rates were necessary to sell equipment and kilowatt-hours to this market on a sound economic basis; second, they knew little about the available equipment, its advantages and its merits as a load builder in its own right and as an advertising medium. Many early applications of electric heat to commercial cooking and baking in hotels and institutions were due to progressive customers and ambitious manufacturers' specialists rather than aggressive sales engineering on the part of the electric light and power companies.

However, these companies, remembering that the electric motor was once looked upon as a highly specialized application, surveyed their commercial markets to find that:

1. There was an average of about 1 kw. of potential commercial cooking and baking load available for each resident customer.



2. That this load had very favorable characteristics and would develop 1,500 to 2,000 kw.-hr. per year for each 1 kw. connected.

3. That it possessed an advertising value in the development of electric cooking in the home.

4. That sales engineers must be trained with a knowledge of food preparation processes that parallels the power engineer's knowledge of industrial processes. That other commercial activities, such as refrigeration and ventilation, might be developed through the same men.

5. That pantry and counter equipment might be sold as opening wedges to extensive installations. This equipment possesses the same operating characteristics as heavier equipment, but does not require any particular technical knowledge to sell. The wayside stand, soda fountain lunch, small restaurant and hotel coffee shops provide a ready market for this equipment even in small villages and towns.

Having surveyed this market a sales engineer was employed to develop it, and while the results were not startling, like industrial heating, this new application of electricity has developed on a growing scale each year.

Now power company executives who are successfully developing this field are contributing able man-power to organized efforts to dig out the facts and develop effective sales material that will assist in developing this load wherever electric service exists. Chain operation of hotels and restaurants automatically passes along word of the economics of electric kitchen operation. Food products—electrically prepared—are producing another market for kilowatt-hours—another helpful answer to the problem of increasing income without adding to capital investment.

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READERS' FORUM

Sprague Protests to Clear the Record

To the Editor of the ELECTRICAL WORLD:

In his recent interesting "Autobiography of an Engineer" friend Emmet, while recording his own achievements in major lines of endeavor and emphasizing his corrective surgery in revivifying decrepit armatures when employed by the Sprague Electric Railway Company in the pioneer days of electric railway development, has, I am sorry to note, voiced an unwarranted collective criticism of many of his early co-laborers.

As his former chief, possibly I am in a better position to judge in fair perspective the merits of the men who were engaged in constructive work, as well as those intrusted with the responsibilities of the installation and supervision of more than a hundred railways, the equipment of which was undertaken by the Sprague company within a space of two years from the date of the pioneer Richmond road, and in justice to those faithful associates and employees I cannot permit at least one of his statements to go unchallenged.

On page 73 of his book he states that "there are few men in the electric industry who have been more uniformly right than Frank Sprague," and then adds that "due to the lack of early mechanical experience" (we both got ours at the Naval Academy) "there was much bad mechanical work and designing in his early apparatus which came largely from the shortcomings of his subordinates, whom he was presumably not capable of very correctly judging."

I have never yet hid my own failings behind my asso-

ciates, however much I may have damned carelessness or stupidity, whether of individuals or manufacture. Every major decision, good or bad, with regard to those early equipments was mine, and whether the mechanical principles were in the main sound may be judged by the fact that most of them have received the indorsement of universal adoption.

As to the capacity to pick capable associates in those days of inexperience in a new art, perhaps I may mention some of them. None are with me now, and some are dead, but I would see that they all are justly defended by one who has not yet forgotten his debt to their loyalty.

Let me call the roll:

H. McL. Harding, one of the most active, aggressive and successful commercial agents of a new business, the promotion of the use of electricity in the industrial and railway fields.

Lt. Oscar T. Crosby, an honor man at West Point, in responsible government engineering work, from which he resigned to become my principal assistant, and who as general superintendent had charge of our manufacturing plant in New York. Later general manager of the railway department of the General Electric Company, a consolidator of street railway systems, a distinguished traveler and finally Assistant Treasurer of the United States.

H. D. Parshall, at first in the railway department of the Sprague company, then taken over as principal railway designer by the Edison General Electric at the time of the Sprague absorption. Afterward an eminent consulting engineer in England and in responsible charge of the equipment of the Central London Railway.

Ensign S. Dana Greene, who resigned from the Navy and was in immediate charge of the Richmond installation, and finally was the head of an important department of the Edison General Electric Company until his untimely and tragic death.

David Mason, who had charge of the equipment of the Union Passenger Railway at St. Joseph, Mo., and who whenever there was trouble anywhere was sent to iron it out, in fully merited confidence he would succeed.

A. D. Lundy, engaged on the Richmond installation and later a partner of the late Fred Sargent, one of the most capable steam engineers in the country, in the firm of Sargent & Lundy, which had charge of the installation of the South Side Elevated Railroad in Chicago, the first to use the multiple-unit system, and many of the largest central-station installations of the Commonwealth Edison Company.

Dr. Cary T. Hutchinson, a fellow in physics of Johns Hopkins University, at first in the railway department of the Sprague company and then of the Edison General Electric, then a partner of Dr. Louis Duncan and myself, and later engineer in charge of many notable electric power and railway installations.

Pat O'Shaughnessy, a master mechanician of great ingenuity and resource, one of the faithful men always available when trouble occurred, who knew no limit of hours or work.

E. P. Wetmore, who, after his early experience with installations in the United States, was put in complete charge of the first installation in Italy, the difficult Florence-Fiesole line, and carried it to success.

William Leroy Emmet, often sent out on the same kind of a job as was Mason and others, where men could be relied upon to give the best there was in them for their company and its clients in a new and untried industrial development, who made good, and has since risen to well-deserved eminence because of notable works.

But why add to this typical list? Who were the supermen available at that time whom Sprague, even with greater capacity, could have brought into his electric family, or who could have acquitted themselves with more credit?

FRANK J. SPRAGUE.

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Lighting Designs Must Meet Architects' Approval

To the Editor of the Electrical World:

The writer has enjoyed very much the article "Urges Large Lamps in Modern Illumination," by an able critic, M. M. Samuels. Much that Mr. Samuels has to say or intimates as to the lack of adaptability on the part of the fixture designer to existing lamps is true, but on the other hand, inasmuch as the general requirement is changing, there would seem to be no reason why the lamp development should remain static.

I am heartily in accord with Mr. Samuels' views as to the need for illumination as well as effects, and in fact I have been preaching this gospel for many years. At the same time, while admitting freely the desirability of using large and readily available lamps wherever possible, there still exists the need for lamps of ample intensity and long enough filaments to adapt them properly to the current need.

It is quite possible to use lamps with rather concentrated filaments (e.g., the present pear-shaped bulb designs in elongated glass cylinders or box-like structures, but to do this means one of two things: (1) The use of the lamp without regard to what the effect of the bright filament will be on the glass, with the result that the studied design is ruined; (2) a careful consideration of the effect of the light spot, and either the incorporating of this in the design or the providing of inner diffusing glasses which will create a mass of light of the required dimensions. The latter expedient is not always possible due to the fact that the introduction of a second glass and the creating of ample space between the glass and the lamp may result in too large a bulk, ruining the design.

Finally, we who are interested in the application of light must needs consider the architectural designer and his feeling toward his creation. It therefore behooves us not only to design such equipment as will produce the lighting effect which the architect will want, but to accomplish this in a manner congruous with the interior in which it is to be used. Mr. Samuels' article, I am sure, will create a great deal of discussion and for his effort he is to be heartily thanked.

JAMES T. HOLMES.

The Frink Corporation,
369 Lexington Avenue, New York.

Men of the Industry

Professors Smith and Phelon Retire

DR. HAROLD B. SMITH, for 35 years head of the department of electrical engineering at the Worcester Polytechnic Institute, has resigned his chair to take effect in June. Professor Smith is one of the best-known figures in the engineering and educational world and served as president of the American Institute of Electrical Engineers in 1929. He was educated at Cornell University, and taught electrical engineering at Arkansas State University and Purdue University, where he founded the electrical department and served as its head for two years. Since 1905 he has been consulting engineer for the Westinghouse Electric & Manufacturing Company and has conducted major research in the field of high-voltage transmission and transformer construction. He plans to take an extended rest before resuming professional practice. A biographical sketch of Professor Smith was published in the ELECTRICAL WORLD of June 29, 1929.

PROF. JOSEPH O. PHELON will retire from the electrical engineering department at Worcester in June, following 44 years of service at the institute. Professor Phelon was educated at Worcester and after several years of teaching in the physics department was transferred in 1896 to the newly formed electrical engineering department. He has been full professor since 1907 and served as acting head of the department from 1911 to 1913. Professor Phelon plans to move to California as soon as his retirement becomes effective.

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F. V. MORRISON, Cedar Rapids, Iowa, has been named manager of the Fairfield, Iowa, branch of the Iowa Electric Company, to fill a vacancy caused by the death of E. N. Gentry.

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V. M. PARSHALL, for the past five years director of the traffic bureau of the State Department of Agriculture and Markets, has been appointed chief of the rate section of the New York State Public Service Commission. A native of Michigan, Mr. Parshall has had nearly twenty years' experience in traffic matters.

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R. E. J. SUMMERS, until recently vice-president and contract manager of the H. K. Ferguson Company, has resigned to become president of Summers Engineers & Constructors, Inc., with offices in Cleveland and in New York City. The Cleveland office is to be managed by Charles H. Fowler, who assisted Mr. Summers in his former connections.

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J. F. Owens Heads Oklahoma Utility

J. F. OWENS was elected president of the Oklahoma Gas & Electric Company at a meeting of the board of directors held in Oklahoma City recently, it has been announced by John J. O'Brien,

president Standard Gas & Electric Company. Mr. Owens has been vice-president and general manager of Oklahoma Gas & Electric Company since 1918. He entered the public utility business as manager of the Baldwin Gas Company, Baldwin, Kan., in 1905, and managed the Wagoner Gas Company at Wagoner, Okla., from 1906 to 1908, when he became connected with the Caney River Gas Company as general superintendent, remaining with that company until he joined the Byllesby organization in 1910 as superintendent of the gas department of the Muskogee Gas & Electric Company, which position he held until 1915. During the latter part of 1915 and 1916 he was superintendent of gas construction and installed gas distribution systems in the towns of Enid, El Reno and Yukon. From that time until his election as vice-president and general manager of the Oklahoma Gas & Electric Company he was manager of the Muskogee Gas & Electric Company at Muskogee, Okla.

Mr. Owens is first vice-president of the National Electric Light Association and for a number of years has taken an active part in the operating, public policy and administrative committee work of the association. He has also taken a very active part in all civic and community affairs in Oklahoma City.

Commenting on the action of the board, Mr. O'Brien said: "I am delighted with the election of Mr. Owens as president of Oklahoma Gas & Electric Company. We have been associated together for many years and Mr. Owens, by virtue of many achievements as a public utility operator as well as the valuable contributions he has made to the progress of the utility industry, is indeed qualified to occupy the position of president of the company with which he has so long been connected."

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Farewell Dinner to H. T. Edgar

HARRY T. EDGAR, who recently retired from the Stone & Webster organization after 32 years' service, was guest of honor at a dinner on May 13 at the Rhode Island Country Club, Barrington, in which nearly 100 of his business associates and friends participated. Lieut.-Gov. Connelly of Rhode Island, C. W. Kellogg, president Engineers Public Service Company, New York; H. H. Hunt of the Stone & Webster Service Corporation, Boston, and others were speakers. David Daly, president of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I., presided. A handsome loose-leaf album, containing congratulatory messages and many souvenirs of Mr. Edgar's professional career, and a check for $1,000 were among the material tributes of the occasion.

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DAVID DALY, president of the Blackstone Valley Gas & Electric Company, has been elected a director of the company to succeed Howard W. Fitz, resigned.

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CHARLES F. STUART has been appointed assistant to the president of the Northern States Power Company. Mr. Stuart has been connected with that utility company since 1918 and has been occupying the position of assistant to the vice-president and general manager. He has been exceedingly active in rural electrification work in the Northwest and for two years was chairman of the rural electric service committee of the National Electric Light Association. Before entering the public utility field

Mr. Stuart engaged in newspaper work in Chicago, Detroit, New Orleans, Cleveland, New York and Minneapolis.

•

GEORGE A. WIEBER has been appointed commercial manager of the Glens Falls division of the New York Power & Light Corporation to succeed E. A. Brand, who has been transferred to the Buffalo office of the Niagara Hudson System. Mr. Wieber went to Glens Falls from the Albany office of the company, where he served as manager of power sales in the commercial department for the past two years. For ten years previous to this Mr. Wieber was associated with the Utica Gas & Electric Company as power engineer and manager of the new-business department.

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H. DONALD MURRAY, formerly connected with the Chester Vally Electric Company of York, Pa., has been named sales manager for Ohio for the Ohio Electric Power Company.

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E. A. DAVIS, vice-president and comptroller of the Middle West Utilities Company, was elected a director of that organization to succeed William A. Fox, resigned.

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L. W. MCLELLAN of the Kentucky Utilities Company, Louisville, Ky., is the new vice-president of the East Central Division of the National Electric Light Association. It was stated in the report of the convention of this division published in ELECTRICAL WORLD May 16 that L. H. Tighe had been elected to this office. Instead of vice-president, Mr. Tighe is a new member of the executive committee of the division.

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FRANK V. MAGALHAES, vice-president for engineering of the Hall Electric Heating Company in Philadelphia for the past 2½ years, has been appointed vice-president and general manager of that company. Mr. Magalhaes became identified with the Hall Electric Heating Company after a number of years' experience in the central-station field. He was with the New York Edison Company for some years in various capacities, serving for the three years prior to his resignation as general superintendent of the distribution and installation department, in charge of the construction and maintenance of the transmission system of that company, the low-tension distribution system in Manhattan and the meter installation and service work. He has been active in various technical associations. He represents the American Institute of Electrical Engineers as alternate member on the electrical committee of the National Fire Protection Association and on the National Fire Waste Council. He has served as vice-president, as well as secretary, of the United States committee of the International Electrotechnical Commission. He is a fellow of the American Institute of Electrical Engineers and a member of the Engineers' Club of New York.

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FRANK J. AIREY, division manager of the General Electric Supply Corporation at Los Angeles, Calif., was elected chairman of the Pacific division of the National Electric Wholesalers' Association. Mr. Airey has been in the electrical merchandising business more than 42 years.

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SAMUEL INSULL, chairman of the Commonwealth Edison Company, returned from Europe May 18 on the North German Lloyd liner *Europa* after a short trip abroad. Mr. Insull spent most of his time in England.

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OBITUARY

A. D. Curtis

AUGUSTUS D. CURTIS, president and founder of Curtis Lighting, Inc., died suddenly, April 29, at Beverly Hills, Calif., at the age of 65. His passing culminates a life devoted to the art and science of illumination, his major contribution being the introduction of indirect lighting. Mr. Curtis was born at Hawley, Pa., October 14, 1865, the son of a country physician. After finishing grade school he removed to Chicago and resumed his training at the old Chicago Athenæum, the Art Institute and evening high school classes. The years that followed found Mr. Curtis associated with a half dozen or more business endeavors, both in and out of Chicago, before he founded the lighting firm bearing his name. In the magazine publishing field he became an influential factor in the success of *Popular Mechanics*. Later he organized the Curtis-Leger Fixture Company, a supply house for window display equipment. It was soon after that the X-ray reflector was developed and was followed by the organization of the National X-Ray Reflector Company in 1897. The name of this company was changed in recent years to Curtis Lighting, Inc.

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GEORGE E. ROE, manager of the Enterprise Electric Works, motor dealers of San Francisco, died in that city April 30. Mr. Roe had been connected for 30 years with the business which he headed at the time of his death. He is succeeded as manager by F. R. Cole, who has been with the firm for the past eighteen years.

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CHARLES B. BURLEIGH, one of the best-known figures in the electrical manufacturing field in New England, died at his home in Malden, Mass., May 6. He was born in Chelsea, Mass., 69 years ago and until his retirement last fall had served the General Electric Company and its predecessors for 46 years. For many years he was manager of the central-station department of the Boston office, later being specially interested in personnel work. During the Spanish War he was in command of the technical division of the volunteer electrical corps in charge of the mining of Boston Harbor, and at the close of the World War he headed a committee for the re-employment of veterans. Mr. Burleigh was a man of wide interests, a past-master in salesmanship and possessed the warm regard of a host of friends in all branches of the electrical industry. A biographical sketch of him was published in the September 6, 1930, issue of the ELECTRICAL WORLD at the time of his retirement.

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THOMAS B. GANNETT, member of the Boston banking and brokerage house of Burr, Gannett & Company, died May 6, as the result of pneumonia. Among other interests, Mr. Gannett was a director of the Galveston Electric Company, the Galveston-Houston Electric Company, North Texas Electric Company, Lawrence Gas & Electric Company and of other utility and industrial corporations. He was a native of Cambridge, Mass., and a former governor of the Investment Bankers' Association of America.

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F. A. ESTEP, formerly chairman of the board of directors of the R. D. Nuttall Company, died April 12 in St. Petersburg, Fla. After some experience in the railroad and industrial fields in 1892 Mr. Estep entered the employ of the Philadelphia Company, of which George Westinghouse was then president. The same year Mr. Estep was appointed auditor of the Allegheny Heating Company, a subsidiary of the Philadelphia Company. In May, 1893, when the Allegheny Heating Company acquired controlling interest in the R. D. Nuttall Company, Mr. Estep was elected president and treasurer, which offices he held until 1925, when he was elected chairman of the board of directors, retaining this position until he retired in 1928. He was 82 years of age.

Financial and Statistical News

FURTHER market liquidation early this week swept utility common stock prices down to 1927 levels and a yield basis of about 5 per cent. This brings the market value of utility securities well below the more or less accepted normal of 1⅓ times physical value of properties. Many issues are now below sixteen times earnings. The ELECTRICAL WORLD index of 37 holding and operating power and light company stocks now stands at 61.7, against 64.6 last week and a high of 74.2 for the year to date. Several issues sold down five or more points during the week.

——WHILE THE SELLING PRESSURE would seem to have been largely professional, especially during the past three weeks, domestic and foreign investment trusts are said to have been liquidating certain issues, owing presumably to the steady market decline and the reduction or omission of dividends on other than utility stocks.

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Banks Switch to Utility Securities

SAVINGS BANKS AND savings departments of other banks have been switching to utility securities from other classes, R. W. Valentine of Halsey, Stuart & Company told the Midwest Regional Savings Conference of the American Bankers' Association at South Bend, Ind., May 11. Mr. Valentine said in part:

Among the different classes of bonds purchased by savings banks, a preference for public utility bonds has been particularly evident. In fact, all during this period the demand for high-grade public utility bonds, especially the mortgage obligations of well-established operating companies, has been a feature of the market. Virtually every important utility bond issued this past year has been well received by the savings banks all over the country. There is good reason for this as the public utility operating companies in general have shown a remarkable stability in earning power, even in the face of the most severe business and industrial depression. This demand has been particularly strong among Eastern savings banks in New York and the New England States. Here we find that legal public utility bonds, along with municipal, probably constitute the favorite medium of investment today for the large number of banks. And this interest in public utility bonds is rapidly gaining in strength, not only in the East but throughout other sections of the country as well.

The change in attitude on the part of savings banks toward railroad bonds has been one of the most striking and interesting developments of recent months. For years this class of bonds has been one of the major mediums of investment for savings banks funds, but the drastic decline in earnings experienced by practically all of our leading railroads in 1930, and the uncertainty regarding operations in 1931 has caused railroad bonds as a class to be subjected to much closer scrutiny and analysis. Unfavorable publicity regarding the problems facing the railroad industry, coupled with severe declines in the market value of many railroad securities, have likewise tended to change the regard which many savings banks have for years held for railroad bonds. This more critical attitude toward railroad bonds, however, has not, so far as we have been able to determine, brought about any substantial liquidation of existing holdings with the view toward shifting to other types of bonds, but it has had the effect of confining the demand quite largely to the strongest underlying issues.

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American Commonwealths Adds New Unit

AMERICAN COMMONWEALTHS POWER CORPORATION of Delaware has launched the American Commonwealths Power Corporation, a New Jersey corporation, with a capital of 1,000,000 shares. The stock is to be owned *in toto* by the Delaware corporation. While the exact function of the new unit has not been made public, President Frank T. Hulswit is reported as stating that its purpose is for building up and extending existing facilities.

In addition to its subsidiaries, the American Commonwealths Power Corporation owns about 10 per cent of the voting stock of the United Light & Power Company and large blocks of American Superpower common, Central Public Service class A common, etc.

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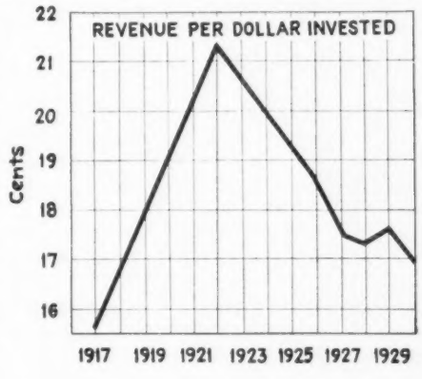
Capital Turnover Slower; Equities Tend to Shrink

DEPRESSED business conditions accentuate certain trends in the power and light industry which suggest economies in certain directions if adequate service is to be rendered at existing low rates. Not only is the return on invested capital declining, but a shrinkage in equities seems to be predicated upon vastly reduced construction costs. Then there is the ever-growing tax burden, which cannot be passed on to the consumer if rates are to continue their downward trend of the past 40 years.



Evidence with regard to the decline in return on invested capital is provided in a study made recently by the National Electric Light Association. This study shows that in 1922 the rate of capital turnover, or the number of years necesary to produce a dollar of revenue for each dollar invested, was 4.7 years. This increased fairly steadily and in 1930 was 5.9 years. Details are shown in the following tabulation:

Year	Avg'e Revenue per Kw.-Hr. Sold, Cents	Revenue per $1 Invested, Cents	Turnover of Capital, Years per
1912.....	2.67	12.6	7.9
1917.....	2.11	15.6	6.4
1922.....	2.83	21.3	4.7
1926.....	2.71	18.6	5.4
1927.....	2.71	17.7	5.6
1928.....	2.66	17.4	5.75
1929.....	2.58	17.6	5.7
1930.....	2.68	16.9	5.9

Another phase of the question is the steady decline in construction costs and general prices from the levels at which existing plant was erected. This suggests at least a temporary shrinkage in equities from those levels. The situation, of course, automatically cor-

rects itself if and as prices return to levels which existed when most of the plants were built. If those prices were abnormally high, as is usually assumed in the case of stock market prices before the break, and if our standard of living is to be more or less permanently lowered, one may assume that a writing-down process will be inevitable some time. There seems little possibility of this, however, if there is anything to the adage that history repeats itself.

Tax burden increases

Another phase of the problem arises out of the growing tax burden in the face of increasing operating costs and, as already shown, a decreasing rate of return on capital. If this annual increment is to be passed on to the consumer, as is generally assumed, then a saving must be effected elsewhere in order to keep power and light rates on a level. The rate of increase in taxation is shown in the following table prepared by the National Electric Light Association:

Taxes Paid to All Taxing Bodies in the United States

Year	Operating Revenues	Taxes	Per-centage
1902.....	$77,473,315	$2,654,885	3.4
1907.....	150,823,287	6,345,796	4.2
1912.....	250,000,000	13,117,198	5.2
1917.....	435,000,000	29,897,106	6.9
1922.....	871,155,119	73,128,440	8.4
1926.....	1,517,000,000	140,400,000	9.3
1927.....	1,666,000,000	157,000,000	9.4
1928.....	1,797,000,000	178,000,000	9.9
1929.....	1,932,000,000	187,500,000	9.7

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Recent Listings

THE NEW YORK STOCK EXCHANGE has recently authorized the listing of first mortgage gold bonds of the Milwaukee Electric Railway & Light Company, 5 per cent series due 1971, to the amount of $15,000,000, and of first mortgage gold bonds, 4½ per cent series, of the New Jersey Power & Light Company to the amount of $3,865,000.

The Montreal Stock Exchange has announced the additional listing of 408,360 shares of no-par value common stock of Montreal Light, Heat & Power Consolidated, bringing the amount of common outstanding up to 4,492,042 shares.

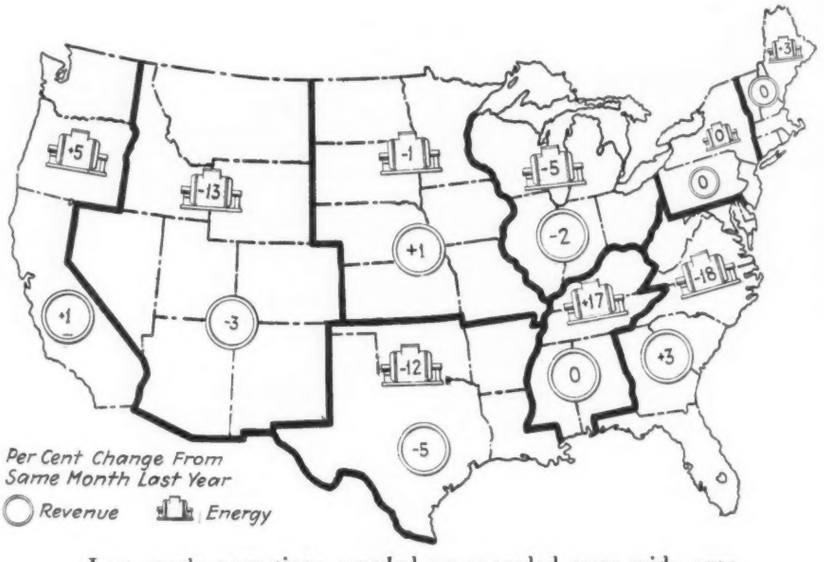
March Operations Close to Last Year's

COMPARED with most other industries, central-station operations continue remarkably close to the highest levels ever attained, due regard being had for the normal seasonal swings.

Revenue in March, as reported to the ELECTRICAL WORLD, was very close to last year's, missing it by 0.2 per cent, and bringing the total for the country to $175,840,000, against $176,200,000 in March, 1930. The decrease from February, which comes every year, was smaller than in 1930 and about as large as in 1929. From January it was a little smaller than in 1930 but larger than in 1929; from December the drop was the same as last year. The smaller deficiency compared with 1930 may also be contrasted with the 1.9 per cent in February.

The inference from these and other comparisons that might be cited is that electrical revenues are moving parallel with their course in the early part of 1929—when the "new economic era" was in full swing; they are 3 per cent greater than in that period of record-breaking operations; the gap which opened in November between current revenues and those a year earlier is closing. This can at present be nothing more than an inference; its correctness must meet the test of the next few months. Meanwhile we have also this guidepost: The total energy generated in January was 8.2 per cent less than in 1930; in February, 7.4 per cent; in March, 3.4 per cent. Here, too, the gap has been closing.

Operating and maintenance expenses, exclusive of taxes, etc., were cut 1 per cent, or somewhat more than revenues, indicating a national total in March, 1931, of $76,260,000 against $77,200,000 in 1930.



Last year's operations equaled or exceeded over wide area

Energy output, 7,408,045,000 kw.-hr., was almost exactly one-third water and two-thirds fuel power, the former being cut nearly 20 per cent from last year, while the latter increased 7.4 per cent to make up the deficiency. Average daily production increased from 237,000,000 kw.-hr. in February to 239,000,000. Other comparisons appear in

Table I—Central-Station Financial Operations in the United States

Compared with Corresponding Month of Previous Year

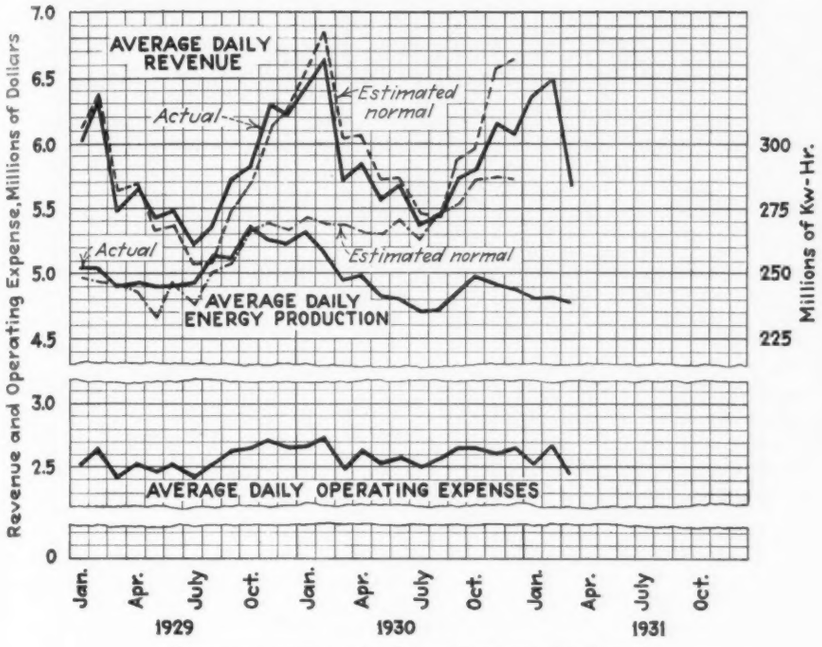
Month	Total Gross Revenue from Sale of Energy*			Total Operating and Maintenance Expense†		
	1930 Thousands	1929 Thousands	Per Cent Inc.	1930 Thousands	1929 Thousands	Per Cent Inc.
December..	$191,920	$192,200	—0.1	$81,890	$82,680	—1.0
	1931	1930		1931	1930	
January....	196,970	198,300	—0.7	78,830	81,480	—3.2
February...	182,280	185,800	—1.9	75,760	77,300	—2.0
March.....	175,840	176,200	—0.2	76,260	77,200	—1.2

Table II—Central-Station Fuel Consumption in the United States‡

Compared with Corresponding Month of Previous Year

Month 1930	Coal		Oil		Gas	
	Short Tons	Per Cent Increase	Barrels	Per Cent Increase	Thousands Cubic Feet	Per Cent Increase
December.....	3,549,648	—4.3	820,002	—23.8	10,089,914	+1.0
1931						
January.....	3,397,171	—7.8	777,857	—27.3	9,987,160	+1.8
February.....	3,016,957	—3.7	614,080	—9.1	9,113,266	—0.7
March.....	3,137,094	—0.6	622,356	+3.5	10,070,767	+7.9

*Aggregate gross revenue from consumers and from other utilities for energy for resale, involving a certain amount of duplication.
†Do not include interest, taxes, depreciation or sinking fund, with some unavoidable exceptions. ‡As collected by U. S. Geological Survey.



Revenue near 1930 figure but output lower

Table III and, by geographical regions, in Table IV.

More regions show gains over 1930 in March than in February. Others show smaller losses. Revenue in the central industrial area was only 2 per cent less; not long ago it was 5 per cent less. Gains also brought the regions along both the Atlantic and the Pacific to parity with last year or better.

Wide changes in regional energy output (Table IV) show heavy shifts between adjacent areas, probably due largely to deficient water power, combined with changes in local loads.

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New Capital Issues

DURING THE WEEK ended May 21 the Central Power & Light Company made an offering of first mortgage 5 per cent gold bonds amounting to $2,500,000. These securities will mature August 1, 1956. Proceeds will be used for reimbursing the treasury for expenditures made on account of additions and improvements to the properties, and for other corporate purposes.

Gulf States Utilities Company issued first mortgage and refunding gold bonds, series B, to the amount of $2,500,000, the price being 94 and interest, to yield 4.88 per cent. The Gulf States Utilities Company, serving 120 communities in Texas and Louisiana, is a constituent company of Engineers Public Service Company.

An eighteen-million-dollar offering was made by the Consolidated Gas, Electric Light & Power Company of Baltimore in the form of first refunding mortgage sinking fund gold bonds, the price being 95½ and accrued interest, yielding 4.21 per cent. Proceeds from the sale of these securities will be used for refunding purposes.

Puget Sound Power & Light Company issued first and refunding mortgage 4½ per cent gold bonds, series D, amounting to $16,000,000 at 94½ and accrued interest, to yield 4.95 per cent.

An issue of 300,000 shares of $5 cumulative preferred stock was offered by the Public Service Electric & Gas Company at $103.50 per share and the Metropolitan Edison Company made an offering of first mortgage gold bonds, series E, at 95 and interest, yielding more than 4.26 per cent, a piece of financing involving a total of $5,000,000.

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News Briefs

Directors of American & Foreign Power Company, Inc., have declared a quarterly dividend of $1.75 a share on the second preferred stock, series A, payable May 29 to stockholders of record May 11. This dividend is for the quarter ended September 30, 1930, and consequently, following this payment, dividends on the stock will accrue from October 1, 1930.

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There has recently appeared a new publication entitled "Investment Banking," the aim of which is to promote the welfare of the investment banking business. In dedicating the first number Harry T. Ferriss, president of the Investment Bankers' Association of America, said: "We dedicate *Investment Banking* to the interest of the members of the Investment Bankers' Association of America in particular, and to the welfare of the investment banking business in general and to that vast army of investors which we serve."

Table III—Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1930	Generated, Thousands of Kw.-Hr.*						Purchased for Resale	
	Total		Hydro		Fuel			
	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Thous. Kw.-Hr.	Per Cent Inc.
December	7,605,855	—4.9	2,186,070	—15.4	5,419,785	—0.1	1,989,000	+7.5
1931								
January	7,487,204	—8.2	2,220,757	—20.4	5,266,447	—1.8	1,995,000	+12.5
February	6,648,506	—7.4	2,047,374	—20.7	4,601,132	+0.1	1,798,000	+10.0
March	7,408,045	—3.4	2,475,157	—19.7	4,932,888	+7.4	1,713,000	+8.0

Table IV—Regional Operations, Revenue and Energy Output in March, 1931

Compared with Corresponding Month of Previous Year

Region	Revenue		Energy Generated, Thousands of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.	Generated	Per Cent Inc.
United States	175,840	—0.2	7,408,045	—3.4	2,475,157	—19.7	4,932,888	+7.4
New England	17,580	—0.1	512,369	+2.8	184,800	—22.6	327,569	+26.1
Middle Atlantic	47,550	+0.4	1,822,850	+0.3	454,477	—22.2	1,368,373	+11.1
East North Central	42,450	—2.3	1,802,185	—4.6	136,505	—39.6	1,665,680	+0.1
West North Central	14,790	+1.2	458,845	—1.4	96,047	—24.4	362,798	+7.2
South Atlantic	19,410	+3.4	878,504	—18.3	431,048	—36.8	447,456	+13.4
East South Central	5,890	—0.4	345,488	+16.6	295,547	+28.7	49,941	—24.8
West South Central	8,610	—4.8	347,867	—12.3	10,311	+56.5	337,556	—13.4
Mountain	4,340	—2.7	252,478	—13.2	195,377	—20.6	57,101	+27.6
Pacific	15,220	+1.1	987,459	+4.5	671,045	—9.6	316,414	+56.5

*By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central-station operations.

Business News and Markets

Allis-Chalmers Purchase Not Yet Official

WHILE DETAILS OF THE expansion of the Allis-Chalmers Manufacturing Company to include the electrical equipment subsidiaries of American Brown Boveri Electric Company have not yet been officially announced, it is understood negotiations are proceeding. Payment will be made in stock, according to a statement attributed to Hayden, Stone & Company, bankers for Allis-Chalmers Manufacturing Company.

It is stated that the deal provides for the purchase also of the Condit Electrical Manufacturing Corporation of Boston, which is owned by American Brown Boveri.

It is also reported that a provisional contract has been made with the Brown Boveri Company of Switzerland whereby Allis-Chalmers Manufacturing Company will have exclusive use of patents and developments pertaining to the lines acquired.

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Westinghouse Obtains Safe Harbor Order

AN ORDER AMOUNTING TO more than $150,000 has been placed with the Westinghouse Electric & Manufacturing Company by the Safe Harbor Water Power Corporation of Safe Harbor, Pa. This order includes two three-phase transformers of 30,000 kva. rating when self-cooled and 45,000 kva. when cooled by air blasts from Westinghouse hood-type blowers.

The transformers will be used to tie together the Safe Harbor and the Holtwood generating stations through a 66,000-volt transmission line.

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Urges Market Studies and Sales Analyses

MARKET STUDIES AND SALES ANALYSES by industrial companies are necessary to restore business activities, according to N. G. Symonds, commercial vice-president of the Westinghouse Electric & Manufacturing Company, who made a tour of the Southwest recently.

"The period of depression will continue for some time, as I see it, especially in our line of business," said Mr. Symonds. "That is the reason for serious sales analyses, because such studies will show a great amount of sales effort is being used up in channels which cannot produce a justifying amount of business. Other markets which in better times have been practically neglected will be found upon close study to yield in a very desirable volume.

"Such periods of depression give the wise executive a chance to analyze his business from a sales standpoint, and the companies that take advantage of this opportunity to eliminate lost motion and misdirected sales effort, reapplying this same or additional effort to known markets, will have their 'decks cleared for action,' ready to step out in the lead as the present condition becomes history. The Westinghouse Electric & Manufacturing Company is at the present time making an extensive market study and analysis and we are finding industries that have a need for our products that are not receiving the proper amount of attention. Our study also will enable us to direct our advertising to those particular channels where we will receive the maximum benefit from it."

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Leaders Discuss Platform for American Business

HOW can American business hasten recovery and guard against future depressions? This problem was discussed by Malcolm Muir, president McGraw-Hill Publishing Company, Inc., before the National Electrical Manufacturers' Association at Hot Springs, Va., this week. Mr. Muir outlined the "Platform for American Business" drawn up by his company and the reaction to it of thousands of America's business and industrial leaders. He said, in part:

"First, the reaction of these men on the maintenance of the American standard of living is extremely interesting. There are two schools of thought, represented by the two recent expressions by Albert H. Wiggin, chairman of the board of the Chase National Bank, and James H. Farrell of the United States Steel Corporation. You will remember that Mr. Wiggin created a great deal of comment last year when he said that the standard of living in this country must come down, that wages must be reduced. But Mr. Farrell was diametrically opposed. He said that the whole structure of American society was based on a high productive power and a high consumptive power per family. He said there was no sense in bringing down incomes to meet commodity prices, that it would be better to bring prices back into balance with prevailing wages.

"Well, a certain number of bankers lined up behind Wiggin. But almost every man of industry who expressed himself on this point indorses the Farrell viewpoint. American business management apparently believes that the American standard of living is right and means to maintain it. The viewpoint of the bankers is not supported by the business man. And these executives are very free and outspoken in their criticism of the banker. They feel that the banker signally failed to meet the situation when the world turned to him for help.

"The so-called technological employment we hear so much about is caused by the fact that we have now no organized procedure which will keep in balance the workers released by improved machines and the increased jobs created by the increased buying power of the man on the new machines. To meet this condition there is a need for a control and a co-ordination in the flux of labor throughout the process of mechanization and modernization.

"There is need also for a definite work of education among those men who are given this new power to produce wealth by this new machinery—education in thrift, education in their own responsibilities and the part they play in the big economic picture. It must be better understood that when men go out of a factory because of better machinery, they go out on a new wave of created buying power in the hands of the men who are left behind with more machinery and more power to create wealth.

Need check on inflation

"The first and most insistent demand on the part of these men is that there be some kind of a brake on inflation and deflation, some kind of control over expansion in boom times and deflation in bad times. For men get the speculative hysteria and build plants at the top of the peak demand to increase production and invade new markets. They neglect to reckon the probable course of business over the next cycle. They grab for

the immediate opportunity, and install more equipment and employ more labor that must be all abandoned when the peak is past. It has got to be controlled in some way.

"There is a growing belief that the banker should function as a brake on such inflation, but this is his responsibility. If the banker will sit on the bulge of the curve of prosperity and will support the curve of depression from underneath, he will be doing for American industry what he is supposed to do. The only way to stop it is by a broader application of long-term planning.

"A few thousand companies in this country employ the bulk of the workers, who in turn support the consuming power of the public. They produce most of the goods and services and are in large part responsible for the maintenance of living standards. Fifty leaders in America, if they would agree on any sound program, could carry it through. Therefore, there is no reason in the world why we shouldn't consider as feasible the eventual development of a more orderly co-ordination of business policy among American business institutions.

"Apparently American business management is not turning to the trade and industry associations for relief from present problems with any great assurance. It would seem that the idea of industry planning is not yet well sold.

"But by and large, since it is admitted that individual corporations working independently have failed adequately to meet these responsibilities by orderly planning and an economic regulation of American business, it seems to me that N.E.M.A. and other industry associations must accept the challenge. There is so much that you can do within the present, also, to develop and distribute the knowledge upon which a better operation within the electrical manufacturing industry must be based.

"I have no intimate understanding of the particular problems that confront you. But I do know that in the main they must be the same that other industries are facing, namely:

1. The need for more comprehensive industry statistics on which to plan production.
2. The analysis of distribution costs and the development of more efficient methods.
3. The study and extension of markets through product development and more effective merchandising.
4. The stabilizing of prices through intelligent self-control based on business knowledge that discourages overproduction and overbuying.
5. The improvement of business ethics through codes of practice and co-operation.
6. The encouragement of progress through research and educational activities.

"As your Mr. Berresford said in an article in ELECTRICAL WORLD recently, 'business has grown without a plan or a program, and yet a plan and a program for business is the greatest national problem of the country.' Such plans and such programs can only be developed and applied industry by industry. Therefore, the leadership of N.E.M.A. is essential to the further progress of the electrical manufacturing industry and it is vital that N.E.M.A. embrace within its membership the full scope of the industry and accept responsibility for this broad function."

Business Has a Social Function*

Business leaders are responsible not only to investors, management and employees—they have a responsibility to the public.

They must therefore become socially minded—must devote themselves as much to this responsibility as to the other responsibilities which they have regarded as their major function.

No government, state or country can exist without income—income is obtained through taxation in some form—taxes cannot be collected unless business and individuals are prosperous.

Governments must therefore not prevent business and individuals from being successful by artificial restrictions and legislation—they must allow business to be prosperous and must themselves be handled economically.

If they are thus conducted, the economies accomplished will automatically weed out incompetent administrators — they will not have to be voted out.

Politicians and statesmen must be made to recognize this fact.

These two conditions are essential to the prosperity of this or any other country.

**From recent address by an outstanding financial and business leader before a confidential gathering.*

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Handbook of Oil Burning

INFORMATION OF PRACTICAL VALUE to the electrician whose work requires a knowledge of electrically operated oil burners is contained in the new Handbook of Oil Burning, just published by the American Oil Burner Association. Besides a thorough treatise on the part played by electricity in the operation of modern oil-burning heating or power plants, the book discusses the different oil burner types and principles of construction, oil burner controls and motors and the wiring of a house or building for an oil burner installation.

Printed in pocket size for convenience, the new handbook contains 629 pages, including 123 tables and 358 illustrations and charts spread over 24 chapters. It can be had at the association headquarters, 342 Madison Avenue, New York.

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New York Metal Prices

	May 13, 1931 Cents per Pound	May 20, 1931 Cents per Pound
Copper, electrolytic	9	8.75
Lead, Am. S. & R. price	3¾	3.75
Antimony	6.65	6.45
Nickel, ingot	35	35
Zinc, spot	3.65	3.65
Tin, Straits	23¾	23.15
Aluminum, 99 per cent.	23.30	23.30

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TRADE BRIEFS

Riley Stoker Corporation, Worcester, Mass., and Badenhausen Corporation, Cornwells Heights, Pa., announce that a consolidation of the two corporations has been effected.

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Bucyrus-Erie Company of South Milwaukee has taken over the manufacture and sale of the "Loadmaster" revolving boom crane, formerly sold by Frederick H. Poor, Inc., New York City.

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On May 1 the Newport News Shipbuilding & Dry Dock Company moved its New York offices from 233 Broadway to 90 Broad Street.

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At a recent meeting of the stockholders of the Link-Belt Company three additional members were elected to the board of directors, thus increasing the total to twelve. The new members are G. P. Torrence, vice-president in charge of the Indianapolis plant; A. L. Livermore, attorney, New York City, and R. W. Yerkes, secretary and treasurer.

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J. Morris Ireland has been appointed special representative for the Westinghouse Electric & Manufacturing Company. F. G. Hickling will succeed Mr. Ireland as manager of the Westinghouse sales organization.

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Charles Croft has been installed as factory representative of the Railway & Industrial Engineering Company in the southern California territory, operating through the Utilities Equipment Corporation, Ltd., Los Angeles, which is the selling agent for the company's generating and substation switching and protective equipment.

Market Conditions

SENTIMENT is somewhat better in equipment buying circles on the Pacific Coast and contracts have continued to improve marginally. The Middle West and Southwest show only slight improvement in inquiries. Actual contracts are still at a low level.

——INDUSTRIAL DEMAND IS STRENGTHENING IN THE Eastern district, but orders are slightly less than a fortnight ago. Inquiries, however, are somewhat more promising

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MIDDLE WEST

—VERY LITTLE CHANGE *in general business conditions is observed this week in the Middle West section. While the volume of business remains substantially the same, recent reports of better business during April are dissipating pessimism to a certain extent.*

—MAJOR ACTIVITIES ARE *in much the same position as last week, with considerable improvement reported in the automotive industry.*

Several of the railroads entering the Chicago area report increases in revenue freight loadings. Industrial activity continues quite spotty, with some increase in employment noted. It is generally supposed that the Jubilee Week just celebrated in Chicago has stimulated retail trade to a considerable extent. The various utility companies are marking time, although a considerable amount of apparatus is on inquiry at the present time. Some of the interesting items placed this week include three 450,000-volt-ampere, three-phase, 60-cycle, 12,000-volt vault type network transformers complete with disconnecting and grounding switches, motor-operated network protectors and balancing transformers, one alternating current calculating board to cost $45,000, five outdoor potential transformers, 500 volt-ampere, 550 to 1 ratio, 66,000/120 volt; two sets filter equipment for 5,000-amp. and one set for 3,333-amp. mercury-arc rectifiers, labor and material for electrical installation, $100,000, and machinery foundation to cost approximately $22,000.

CONSTRUCTION PROJECTS

Wisconsin Power & Light Company, Madison, Wis., will build a transmission line from Fond du Lac to Janesville, Wis. A. L. Randall Company, Chicago, Ill., plans improvements in furniture manufacturing plant to cost over $250,000. Board of Education, Peoria, Ill., will install vocational shops in proposed junior high school to cost $700,000. Public Lighting Commission, Detroit, Mich., plans power substation on Grand River Avenue to cost $125,000, and will build an equipment storage and shop to cost $45,000. Newton Steel Company, Youngstown, Ohio, contemplates extensions and improvements in mill at Newton Falls, Ohio, to cost close to $750,000. John Carroll University, Cleveland, Ohio, has filed plans for group of new buildings to cost $2,500,000. Great Northern Railway Company, St. Paul, Minn., will proceed with superstructure for power plant at Williston, N. D., to cost $85,000, and contemplates new power plant at Havre, Mont., to cost over $100,000.

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SOUTHEAST

—REPORTS FROM ELECTRICAL *manufacturers and jobbers indicate that while April business was the best month of the year as a result of the number of small orders, the level of business continues unsatisfactory. Though warmer weather may accelerate activities somewhat, it is felt that the remainder of the year will not witness any marked increase in business activity.*

Transformers seemed the most active item last week, one company buying three 500-kva. and three 100-kva. transformers and $2,000 worth of current transformers. Another company's distribution and small power transformer purchases last week aggregated $10,500, while still another company ordered $1,000 worth of distribution transformers; all these orders were from Georgia. There is in prospect for the next few weeks an order approximating $10,000 for network transformers and protectors for the New Orleans district. Bids have been asked on two cars of bare copper wire for a west Florida power company and a Georgia company bought one carload of fiber conduit this past week. Oil circuit breaker equipment amounting to $15,000 was ordered from New Orleans in connection with the city pumping system, and a Georgia textile mill ordered supplies amounting to $3,000 for use in rearrangement of plant machinery.

CONSTRUCTION PROJECTS

Appalachian Electric Power Company, Charleston, W. Va., has filed plans for an equipment storage and distributing plant to cost about $65,000. Board of Education, Norfolk, Va., plans manual training department in new junior high school to cost $650,000. Georgia Power Company, Atlanta, Ga., plans transmission line from Albany to Americus, Ga., and vicinity, to operate at 44,000 volts.

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EASTERN

—ELECTRICAL EQUIPMENT IS MOVING *under fair impetus in the Eastern district, and while orders are not reaching quite the volume of those of a fortnight ago, there is no lack of interest in impending account. Industrial demand is exhibiting greater strength and there seems more inclination of buyers to place commitments; iron and steel mills, chemical factories, paper mills and food products plants present the best potential possibilities at the moment.*

—CENTRAL-STATION ORDERS *are still much restricted and business is limited to immediate requirements, primarily for substation or line installations. Government account is developing marked interest on the part of a sizable number of equipment manufacturers.*

Westinghouse Electric & Manufacturing Company will furnish complete electrical apparatus for a new Diesel engine-electric ferry boat to be built for the San Diego and Coronado Ferry Company, consisting of three 285-kw. d.c. generator units to supply power for propulsion motors, three 30-kw. exciters and auxiliary equipment; the majority of the machinery will be manufactured at the South Philadelphia works of the company.

New York Power & Light Company has placed a contract with the Lapp Insulator Company for a quantity of suspension type insulators, aggregating about 47,000 units, for its proposed new transmission lines in the vicinity of Albany and to the south. The Lapp company has been running on a capacity schedule for a number of months and this order, with other incoming business, assures continuance on that basis until well into the fall season. A metropolitan central station has contracted with a New York maker for cable to an amount of $30,000. A Texas municipality has placed an order for power plant equipment with a Middle West manufacturer, including two generators, two oil-burning engines and auxiliary apparatus. A total of eleven bidders tendered quotations for a Diesel engine-generator set for the Quartermaster Department, United States Army, Governors Island, New York, the order going to Fairbanks, Morse & Company. National Tube Company has contracted with Westinghouse Electric & Manufacturing Company for

80 motors of various capacities, ranging from nominal to 400 hp.; there will be four of 200 hp. and ten of 100 hp. rating. The equipment will be used at the Elwood City, Pa., plant of the purchaser.

CONSTRUCTION PROJECTS

New York Steam Corporation, New York, plans power plant to cost $2,100,000. New York Telephone Company, New York, has plans under way for an equipment storage and distributing plant at Newark, N. J., to cost $750,000. General Electric Company, Schenectady, N. Y., has plans for a factory branch and distributing plant at Detroit, Mich., to cost close to $300,000. Signal Supply Officer, Army Base, Brooklyn, N. Y., will receive bids until June 2 for 300 telephone boxes (Circular 155). New Jersey Power & Light Company, Asbury Park, N. J., plans construction of a transmission line from power plant at South Amboy to Sayreville, N. J. Hotel Traymore, Atlantic City, N. J., plans addition to cost over $1,000,000. Bethlehem Steel Company, South Bethlehem, Pa., plans extensions in plant at Vernon, Calif., to cost over $1,000,000. United Engineers & Constructors, Inc., Philadelphia, Pa., will prepare plans for central power plant and substation at Washington, D. C., for the Treasury Department, to cost $5,749,000. Department of Commerce, Washington, D. C., will receive bids until June 1 for 2¼-kw. engine-generator plants (Proposal 23270). General Purchasing Agent, Panama Canal, Washington, D. C., will receive bids until June 8 for oil circuit breakers, electric cable, ten storage battery charging rectifiers, knife switches, etc. (Panama Schedule 2657).

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SOUTHWEST

—IT WAS NOTED *that during the first three months of 1931 there was practically no demand for meters and it is interesting to learn that for the last six weeks a normal number of meter orders have been received.*

The shipments of small motors and distribution transformers have been holding up very well. There are some fair-sized contracts in prospect which should be closed in the next month. The only contracts reported were for two 1,000-ft. surface condensers for a local paint manufacturing company, $8,000, and a white-way job for a southern Missouri municipal company, $3,000.

CONSTRUCTION PROJECTS

St. Louis, Mo., plans installation of an electric traffic signal system to cost about $70,000. Atchison, Topeka & Santa Fe Railway Company, Chicago, Ill., has approved plans for an electric-operated coaling plant at Boise City, Okla., to cost over $90,000. Central Power & Light Company, San Antonio, Tex., plans transmission line in vicinity of Bayside, Tex., with power substation and distributing lines. Gulf States Utilities Company, Beaumont, Tex., plans construction of transmission lines for service at High Island oil field district, including power substation.

PACIFIC COAST

—THE PACIFIC COAST *as a whole being comparatively unaffected by recent market factors, its leaders realize the importance of minimizing their psychological effect. However, skilled labor wages and the effect of 1930 overproduction and 1931 underproduction of certain crops are uncertainties and are hampering building construction and electrical buying generally. Contracting materials are steadily improving.*

Certain major building construction, such as the $2,500,000 San Francisco war memorial, the $1,500,000 Sacramento post office, a $4,000,000 combined office building and church tower group in Los Angeles and a suggested $1,000,000 civic group for Glendale, provide sure orders for fall. Other large projects, such as the turbine plant near Fresno, conservatively estimated to include $1,250,000 worth of electrical machinery and the general petroleum plant, are said to have been indefinitely postponed. A blanket contract covering wiring material for Boulder City and the Hoover Dam has been awarded to the General Electric Company. The past week has been exceptionally prolific in electric machinery, including four Westinghouse transformers valued at $140,000 for Seattle, voltage regulators valued at $50,000 and a carload of electric ranges valued at $12,000, all reported by Westinghouse for the northwest; motors and control orders totaling $40,000 for San Francisco and five 600-amp. and four 200-amp., 33,000-volt circuit breakers for Glendale, and transformers and motors for Anaheim. Government buying is temporarily lighter, but includes lead-covered cable, a $6,300 San Francisco award and a 200-line telephone switchboard. Conduit prices are steadier, but rubber-covered wire has dropped in response to the low copper base.

West Kootenay Power & Light Company has made application at Victoria, B. C., for permission to establish its fifth hydro-electric power development on Kootenay River, opposite Brilliant. This completes harnessing of the entire river's flow from Kootenay Lake to Columbia River; the reported planned development will be 30,000 hp. James Leffel & Company, bidding about $18,000, secured the contract from the town of Idaho Falls, Idaho, for furnishing an 1,800-hp. waterwheel for the projected hydro development. Bids submitted for one 1,500-kva. generator and 3,000 kva. transformers, switchboard and accessories were taken under consideration. Sales reported last week include 50 motors from 150 hp. down to pulp and paper mills, scattered industrials and miscellaneous sources, twelve machines from 10 hp. down to a sawmill, 25 machines ranging from 50 hp. down to dealers and small industrials, two 10 hp. and four 5 hp. to a mill, 35 machines from 100 hp. down to scattered sources and 30 transformers from 1½ to 10 kva. to local central stations.

CONSTRUCTION PROJECTS

United States Army, Washington, D. C., will have plans drawn under direction of Captain H. B. Murse, San Rafael, Calif., for group of buildings for an army bombing base near Novata, Calif., to cost about $5,000,000. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until June 9 for two motor-generator sets for Mare Island, Calif., navy yard (Schedule 5759). Letisine Vitamin Company, Watsonville, Calif., has completed plans for a food products plant to cost about $80,000. Portland Canal Power Company, Exchange Building, Seattle, Wash., has secured permission for hydro-electric power plant in Alaska to cost over $1,000,000.

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NEW ENGLAND

—REPORTS RECEIVED FROM *manufacturers show uneven trends, with buying limited to small lots, principally of power equipment, including small motors and control apparatus.*

One order of interest reported amounted to about $60,000 and included a motor-generator set and switch and control apparatus for a new substation for the Navy Yard in this district. Small motor orders are increasing, according to one manufacturer, who reports encouragement due to increase in volume in May over April. One order for small motors amounting to about $4,000 is noted and several smaller group orders are recorded.

There has been little change in demand for line material and new construction needs, the latter holding much less promise this season on account of curtailment of building. According to one manufacturer there has been some hesitancy in buying, due to lack of stability in price, fluctuations affecting wire and cable orders for large quantities. On the other hand, certain districts, such as Maine, show improving conditions and betterment as compared with last year.

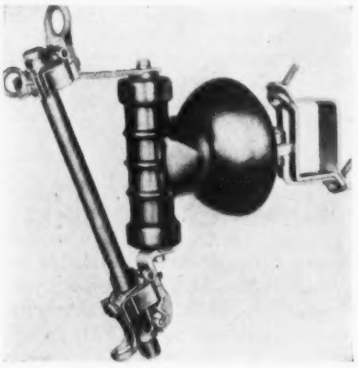
CONSTRUCTION PROJECTS

Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until May 26 for 11,720 condensers for Portsmouth, N. H., navy yard (Schedule 5785). American Writing Paper Company, Holyoke, Mass., has approved plans for alterations and improvements in mill, including electrification of equipment, to cost about $100,000. Eastern Massachusetts Street Railway Company, Boston, Mass., plans motor bus garage and service building to cost about $100,000.

New Equipment Available

Open Type Switch Has High Flashover Value

AN OPEN-TYPE Matthews "Fuswitch," for which are claimed extraordinarily high flashover values due to the design of the one-piece wet process porcelain insulator, has been announced by the W. N. Matthews Corporation. The 1400 and 1401 are rated at 7,500/12,500 grounded Y volts and 30 and 60



amp., respectively. The 1406 and 1407 are rated at 15,000 volts and 30 and 60 amp., respectively. Before the "Fuswitches" were finally approved for production they were given an accelerated life test.

The open-type "Fuswitch" or cutout is compact and light in weight, yet has high mechanical strength. Due to its light weight, freight costs are greatly reduced. In some instances the new open-type "Fuswitch" weighs up to 18 lb. less than other open types of the same rating and yet has a higher standard of performance.

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Pumping Unit Includes Gears, Motor and Control

SEVERAL ADVANCES IN DESIGN and construction are claimed for the new unit pumping equipment manufactured by Nuttall Works of the Westinghouse Electric & Manufacturing Company and Oil Well Supply Company. It is claimed to be the first and only electric pumping power having the entire drive, reduction gears, motor and control combined into a single compact unit of weatherproof construction, thus entirely eliminating the necessity for any shelter house. This unit drive assembly requires only one foundation and once in place there remains only the connection of three wires between the control and the power supply. All other wiring is done during manufacture.

The high-torque, squirrel-cage type a.c. motor is reduced to its bare elements of rotor and primary core with coils. It has no separate frame, no feet, shaft, brackets or bearings.

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A NEWLY DESIGNED REVERSIBLE RATCHET has been devised by the Lowell Wrench Company, Worcester, Mass., for making wire connections and similar purposes. It enables the workman to work in compact places with less chance of coming in contact with wires and other obstacles. These tools are made in three sizes. The No. 1 and No. 3 are insulated with micarta tubing and knurls for protection.

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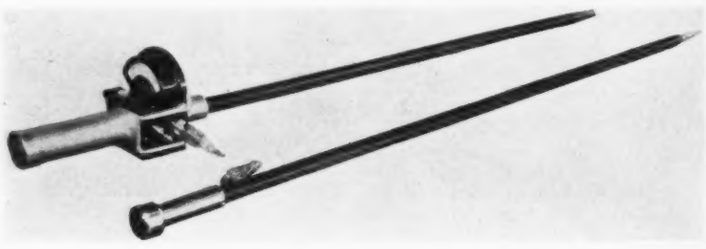
Earth Resistivity Meter

FOLLOWING EXTENSIVE RESEARCH WORK which the Bureau of Standards has been carrying on for several years, a new instrument has been developed for simply and quickly measuring the electrical resistivity of soil in place.

The device is called the Shepard earth resistivity meter, having been developed by E. R. Shepard of the Bureau of Standards, and has been put on the market by O. S. Peters, Washington, D. C. It consists of two rods or canes tipped with iron electrodes. A flashlight battery and milliammeter are mounted in a light aluminum frame on one of the rods. The rods are pushed into the earth with a separation of about 1 ft. or more, at the bottom of a pair of auger holes, a shallow excavation or the side of an open trench. The circuit is then closed and the resistivity of the soil is read directly in ohm-centimeters on the scale of the instrument. Two scales are provided on the

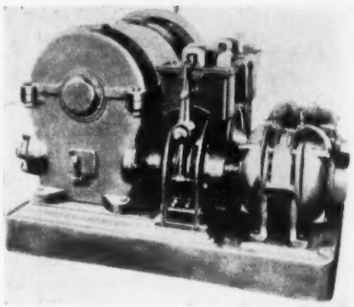


meter, one ranging from 400 ohm-cm. upward and the other from 100 to 500 ohm-cm. Provision is also made for checking the voltage of the 3-volt flashlight battery carried in the handle rod.

Hoisting Machine Uses Low Cost Motors

A NEW DESIGN OF HOISTING MACHINE which, it is stated, effects economy in initial cost, maintenance and power has been announced by the Watson Elevator Company, New York. Precision floor stops and uninterrupted operation are claimed by this new unit, known as the "Duplex" elevator.

One of the principal features of the "Duplex" elevator is the fact that first-class service is obtained through the use of the lowest cost motors. The single-speed, high-speed, squirrel-cage,



alternating-current motors permitted by this new design not only cost less but are more reliable and efficient than any other electric power units utilized in elevator service, according to the manufacturer.

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Truck Motor Used in Crane Operation

WHAT IS STATED to be the first power truck crane in which all the functions are power operations is announced by the Silent Hoist Winch & Crane Company of Brooklyn, N. Y. Power from the truck motor is used in all operations, including load line and raising and lowering of the boom. Less than 40 in. of space is needed back of the cab.

The crane has a rated capacity of 5 tons at a 6-ft. radius from the side of the truck and with the boom 12 ft. long can also handle loads up to 2½ tons at a 12-ft. radius or horizontal reach. The height of the crane from the top of the chassis frame is 7 ft. 9 in.